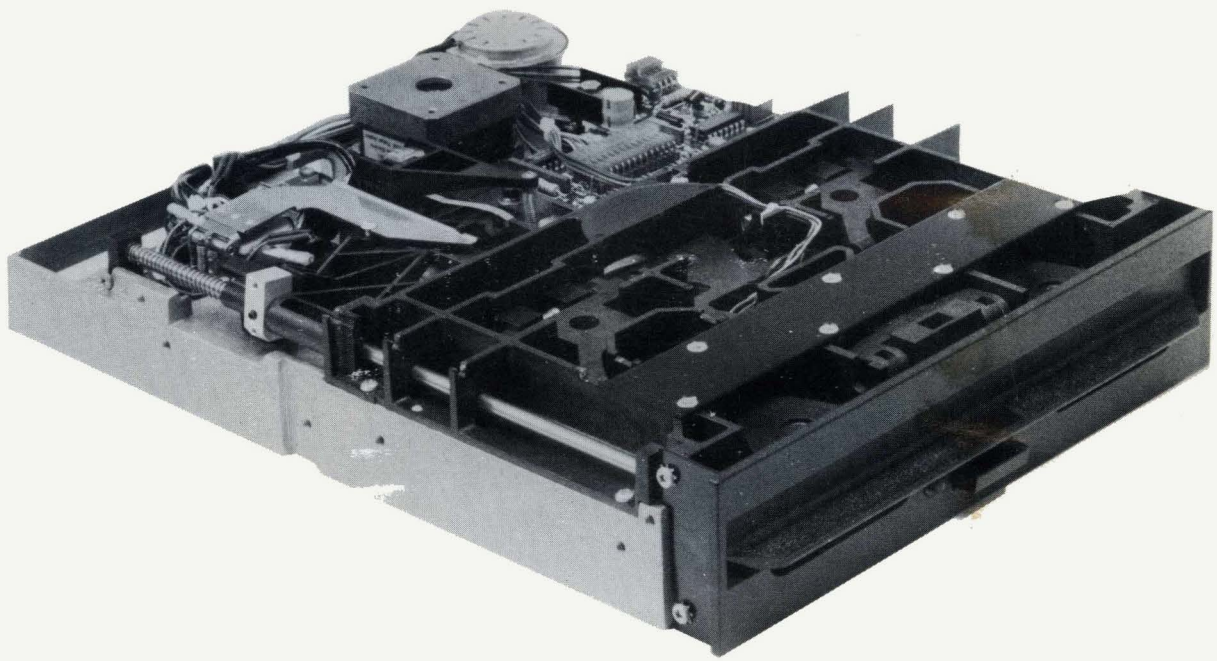
MPI

8 INCH SLIMLINE

FLEXIBLE DISK DRIVE

PRODUCT MANUAL



MICRO PERIPHERALS INC.

8 INCH SLIMLINE

Flexible Disk Drive

Product Manual

P/N 03028-001

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The purpose of this document is to provide the user of MPI's Model 40 Series Flexible Disk Drives with adequately detailed information necessary to properly install, configure, and operate the equipment supplied.

Every effort has been made to keep the information contained in this document current and accurate as of the date of publication or revision. However, no guarantee is given or implied that the guide is error free, or that it is accurate with regard to any particular specification.

Published April 1983

TECHNICAL ASSISTANCE

Should it be needed, technical assistance is available through the Technical Service Group at MPI. Contact them by telephone at (213) 709-8209, or by mail at 9754 Deering Avenue, Chatsworth, Ca. 91311.

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SECTION 1

GENERAL DESCRIPTION

1.1 INTRODUCTION

The MPI Model 40 Series diskette storage drives represent the latest evolutionary development in the 8 inch floppy disk product family. The Model 40 Series brings to the 8 inch market the latest technology enhancements from the 5 1/4 inch marketplace and is packaged in the most versatile format to permit special customer options without affecting the basic mechanism design. There are four versions of the Model 40 Series Disk Drives. They are the 41/42M (2.0" single Slimline™), 41/42H (2.3" single Slimline™), 41D/42D (dual Slimline™), and the 41S/42S (Slimline™ drive mounted in a full-size, industry standard compatable bezel). These drives are illustrated in figures 1-1, 1-2, and 1-3.

NOTE

A high level of commonality exists between the 41/42M, 41/42H, 41D/42D, and 41S/42S drives. Therefore the following descriptions will generally apply to all models. Unique features of each model will be identified and individually described, as appropriate. For ease of explanation, flexible disk drives discussed in this documentation will be referred to as the Model 40 Series unless differentiation is necessary.

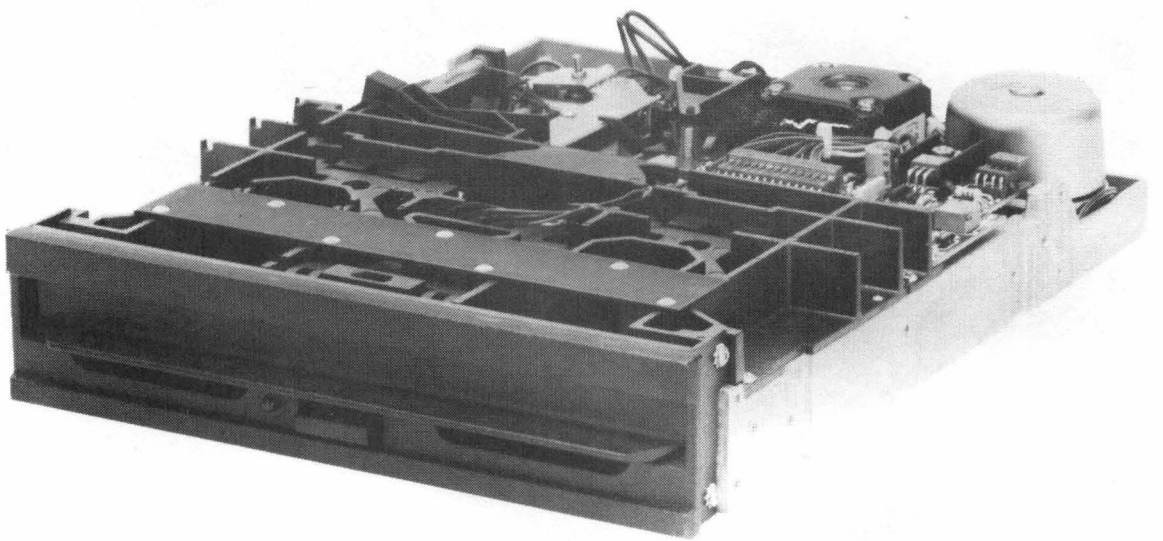


Figure 1-1: 41/42 M(H) Disk Drive

1.2 DOCUMENTATION COMPOSITION

This product manual provides the information necessary to properly install, configure, operate, and maintain the Micro Peripherals Inc. Model 40 Series Disk Drives. Contents and sectional arrangement of this document are as listed:

Section 1 - General Description

Section 2 - Installation and Operation

Section 3 - Theory of Operation

Section 4 - Maintenance

Section 5 - Troubleshooting

Section 6 - Optional Configuration

Appendix A - Recommended Spare Parts List

Appendix B - Schematics

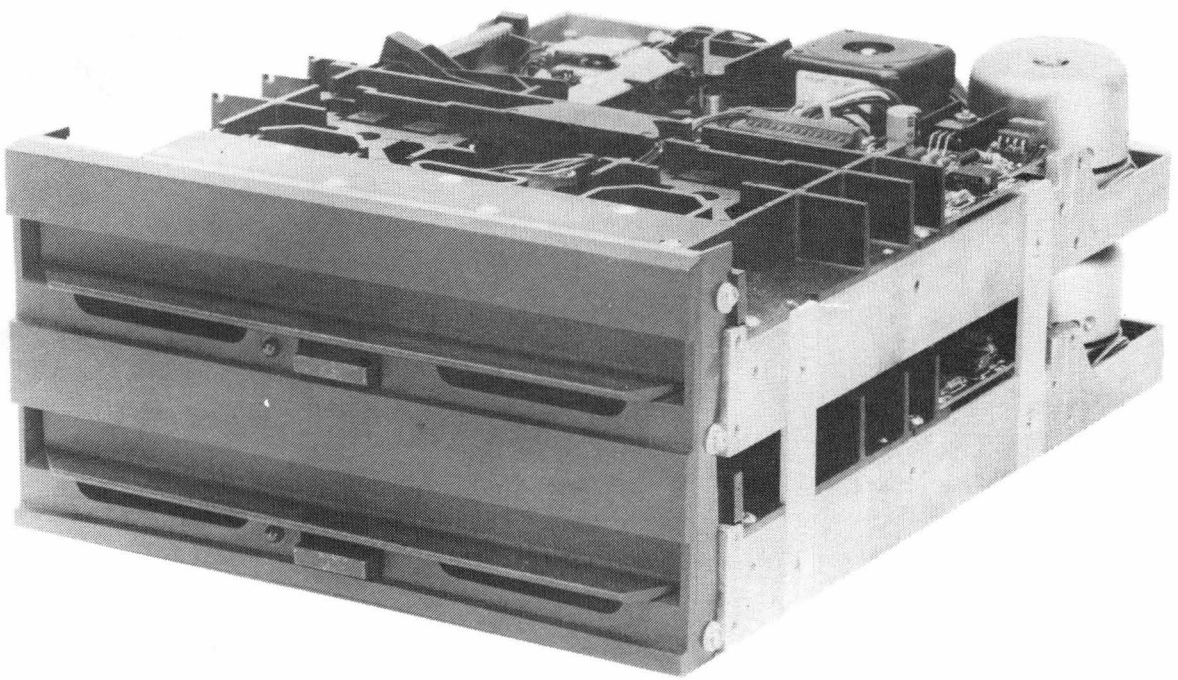


Figure 1-2: 41D/42D Disk Drive

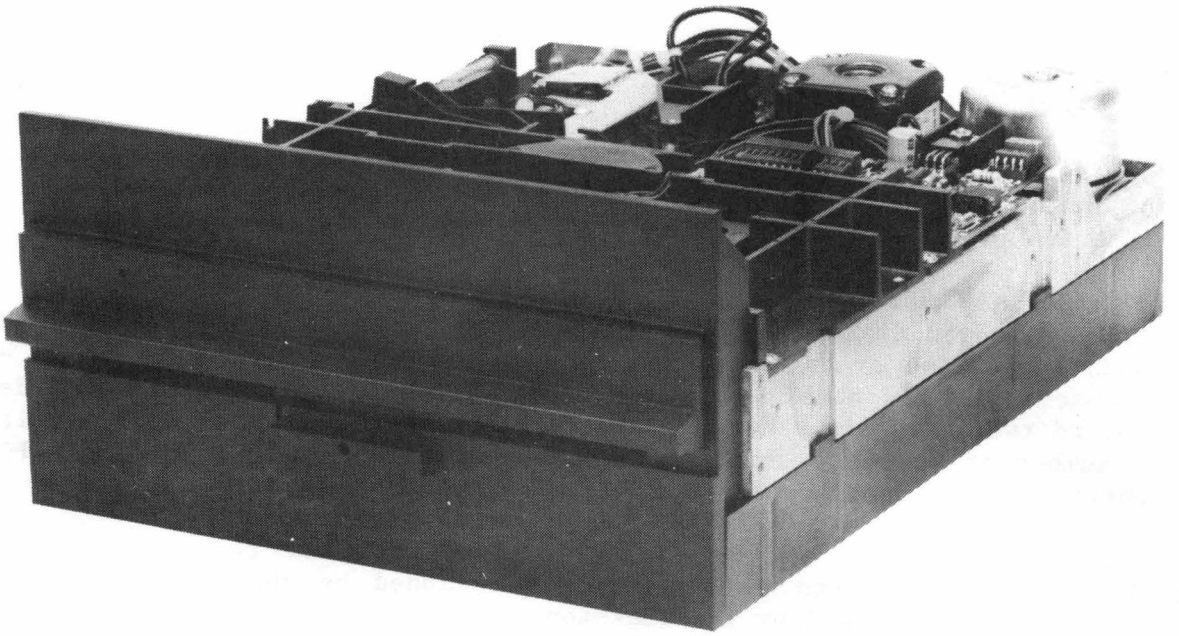


Figure 1-3: 41S/42S Disk Drive

1.3 PURPOSE OF EQUIPMENT

The Model 40 Series Disk Drives are high-speed, random access devices which store data on and retrieve data from an oxide-coated mylar diskette that is 8 inches (20.32 cm) in diameter. It provides a highly reliable and compact solution to problems of low-cost data storage.

Typically, floppy disk drives are used with intelligent terminal controllers, microcomputers, word processing systems, data communications systems, error logging, microprogram loading, and point-of-sale terminals. The Model 40 Series is designed to meet and perform to ANSI specification, utilizing standard 8 inch diskettes.

1.4 PHYSICAL DESCRIPTION

The Model 40 Series can be mounted vertically or horizonally. However, when mounted horizonally, it is recommended that the drive be positioned with its top side up (refer to figure 4-1). The mechanical components consist of an aluminum chassis, on which is mounted a spindle (belt-driven by a DC motor); a stepper motor/band combination for positioning the magnetic head assembly; and a cone/clutch assembly for centering and holding the recording media under operation. Access for diskette loading is at the front of the drive.

The recording-head assembly is of a glass bonded ferrite/ceramic structure, with lifetime expectancy in excess of 20,000 hours. The electronic circuitry is mounted on two circuit cards. The spindle speed PCBA controls the drive spindle, and the control electronics PCBA controls all other functions of the drive. Power and interface signals plug directly into the control electronics PCBA.

1.5 FUNCTIONAL DESCRIPTION

The Model 40 Series is self-contained and requires no operator intervention during operation. The drive consists of a media-rotating system, a head-load and positioning system, and a write/erase and read system.

The MPI Model 40 Series storage drives read and write in single or double density on standard diskettes. The MPI Model 41 provides storage on one side of standard diskette or on both sides if the "flippy" option is requested by the customer. The MPI Model 42 provides for information storage on both sides of standard two-sided diskettes. The only difference between these two units is the number of heads in the disk drive and storage capacity. The logic PCB is identical in all models.

When the front door is opened, access is provided for the insertion of a diskette. The diskette is accurately positioned by chassis guides, the front latch inhibitor, and by the backstop. Closing the front door activates the cone/clutch system, resulting in centering of the diskette and clamping it to the spindle hub. The spindle hub is driven at a constant speed of 360 RPM by a servo-controlled DC motor.

When the drive is in operation, it is important that the head-to-media relationship be controlled. This is accomplished by the head-load system in the following way: When the door is closed the media is pressed against the lower head; the Index sensor is referenced to the head and the spindle hub; and the upper head in the Model 42 drive, or the felt pad in the Model 41 drive, is loaded against the media on the opposite side of the head with a force of approximately 20 grams.

The recording head(s) is positioned over the correct track by means of a four-phase stepper motor/band mechanism, and its associated electronics. A one-step movement causes a one-track movement. With band positioning, very high step rates can be accomplished with the Model 40 Series system.

1.6 SPECIFICATION SUMMARY

This section provides mechanical and electrical specifications and information relevant in understanding the characteristics of the MPI Model 40 Series Flexible Disk Drive. The Model 40 Series specifications have been catagorized under the following headings:

A. Performance

B. Function

C. Physical

D. Reliability

	MODEL 41		MODEL 42	
	SINGLE DENSITY	DOUBLE DENSITY	SINGLE DENSITY	DOUBLE DENSITY

1.6.1 Performance Specifications

Capacity (Kilobytes)				
Unformatted				
Per disk	400	800	800	1600
Per surface	400	800	400	800
Per track	5.2	10.4	5.2	10.4
IBM Format (128 Byte Sectors)				
Per disk	250	500	500	1000
Per surface	250	500	250	500
Per track	3.3	6.6	3.3	6.6
Transfer Rate (K Bits/sec)	250	500	250	500
Latency Time (Avg)	83 ms	83 ms	83 ms	83 ms
Access Time				
Track to track	3 ms	3 ms	3 ms	3 ms
Average (includes settling)	91 ms	91 ms	91 ms	91 ms
Settling time	8 ms	8 ms	15 ms	15 ms
Head load time	35 ms	35 ms	35 ms	35 ms

1.6.2 Functional Specifications

Rotational speed	360 RPM	360 RPM	360 RPM	360 RPM
Speed error	±1.5%	±1.5%	±1.5%	±1.5%
Recording density (inside track)	3200 BPI	6400 BPI	3408 BPI	6816 BPI
Flux density	6400 FCI	6400 FCI	6816 FCI	6816 FCI
Track density	48 TPI	48 TPI	48 TPI	48 TPI
Cylinders	77	77	77	77
Tracks	77	77	154	154
Heads	1	1	2	2
Physical sectors	0,8,16,32	0,8,16,32	0,8,16,32	0,8,16,32
Index	1	1	1	1
Encoding methods	FM	MFM	FM	MFM

1.6.3 Physical Specifications

Environment limits

Ambient temperature	40°F to 115°F (4.4°C to 46.1°C)
Relative humidity	20% to 80% non-condensing
maximum wet bulb	78°F (25°C)

AC power requirements	None required

DC voltage requirements (per drive)

+ 24 VDC ± 10%	1.25A typical (2.0A max for 0.5 sec when Spindle Motor is activated)
+ 5 VDC ± 5%	1.00A typical

Heat dissipation 35 watts typical; 7.5 watts standby

Mechanical dimensions (exclusive of front panel)

	MPI 41/42M (H)	MPI 41D/42D	MPI 41S/42S
Height	2 in (2.3")	4.62 in	4.62 in
Width	8.55 in.	8.55 in.	8.55 in.
Depth	11.50 in.	11.50 in.	11.50 in.
Weight	6 lbs	13 lbs	7 lbs

1.6.4 Reliability Specifications

MTBF	5000 POH under heavy usage 8000 POH under typical usage
MTTR	30 minutes
Component life	15,000 POH

Error rates (Media errors not included)

Soft read errors	1 per 10^9 bits read
Hard read errors	1 per 10^{12} bits read
Seek errors	1 per 10^6 seeks

Media life:

Passes per track	3.5×10^6
Insertions	30,000+

SECTION 2

INSTALLATION AND OPERATION

2.1 INTRODUCTION

This section provides mounting information and procedures necessary for proper installation and operation of the Model 40 Series Disk Drives.

2.2 UNPACKING

CAUTION

During unpacking, care must be exercised to ensure that all tools are non-magnetic and do not inflict damage to the unit.

As the unit is unpacked, inspect it for possible shipping damage. All claims for this type of damage should be filed promptly with the transporter involved. If a claim is filed for damages, save the original packing material. Most packing material may be reuseable if reasonable care is used in unpacking. If reshipment is required, be sure to insert the shipping disk that was shipped with the unit and close the door. Unpack the drive as follows:

A. Remove external packing material carefully.

B. Remove the drive from the container.

C. Remove internal packing materials.

D. Ensure that front access door opens and closes, and that the head-load arm raises when door is opened.

E. Ensure that bezel is secured.

F. Ensure that drive hub manually rotates freely.

G. Ensure that stepper motor/head carriage assembly is not binding at any point by manually moving carriage back and forth.

2.3 MOUNTING RECOMMENDATIONS

Due to its unusually small size and light weight, the Model 40 Series can be installed in any convenient location, and in one of the three following attitudes:

A. Vertical - Door opening left or right.

B. Horizontal - Door opening upwards.

C. Upright - Door opening forward or backwards.

Because the flexible disk drive is a precision device in which certain critical internal alignments must be maintained, it is important that the mounting scheme does not introduce significant stress on the drive. In addition, mounting schemes involving more than two hard mounting points should be avoided. Slide mounting generally satisfies the stress mounting requirements for the drive, as long as adjustable brackets or resilient members are used to accommodate tolerances. Figures 2-1, 2-2, and 2-3 show all pertinent dimensions for mounting the Models 41/42M(H), 41D/42D, and 41S/42S Disk Drives, respectively.

CAUTION

Any mounting scheme in which the drive is part of the structural integrity of the enclosure is not permitted.

2.4 DUST COVER

Since the flexible disk drive is not provided with a dust cover, the design of an enclosure should incorporate a means to prevent direct ingress of loose items (e.g. dust, paper punch waste, etc).

2.5 COOLING

Heat dissipation from a single disk drive is normally less than 35 watts (93 Btu/Hr). When the drive is mounted so that the components have access to free flow of air, normal convection cooling allows operation over the specified temperature range. When the drive is mounted in a confined environment, air flow may have to be provided to maintain specified air temperatures in the vicinity of the motors, PCBA, and the diskette.

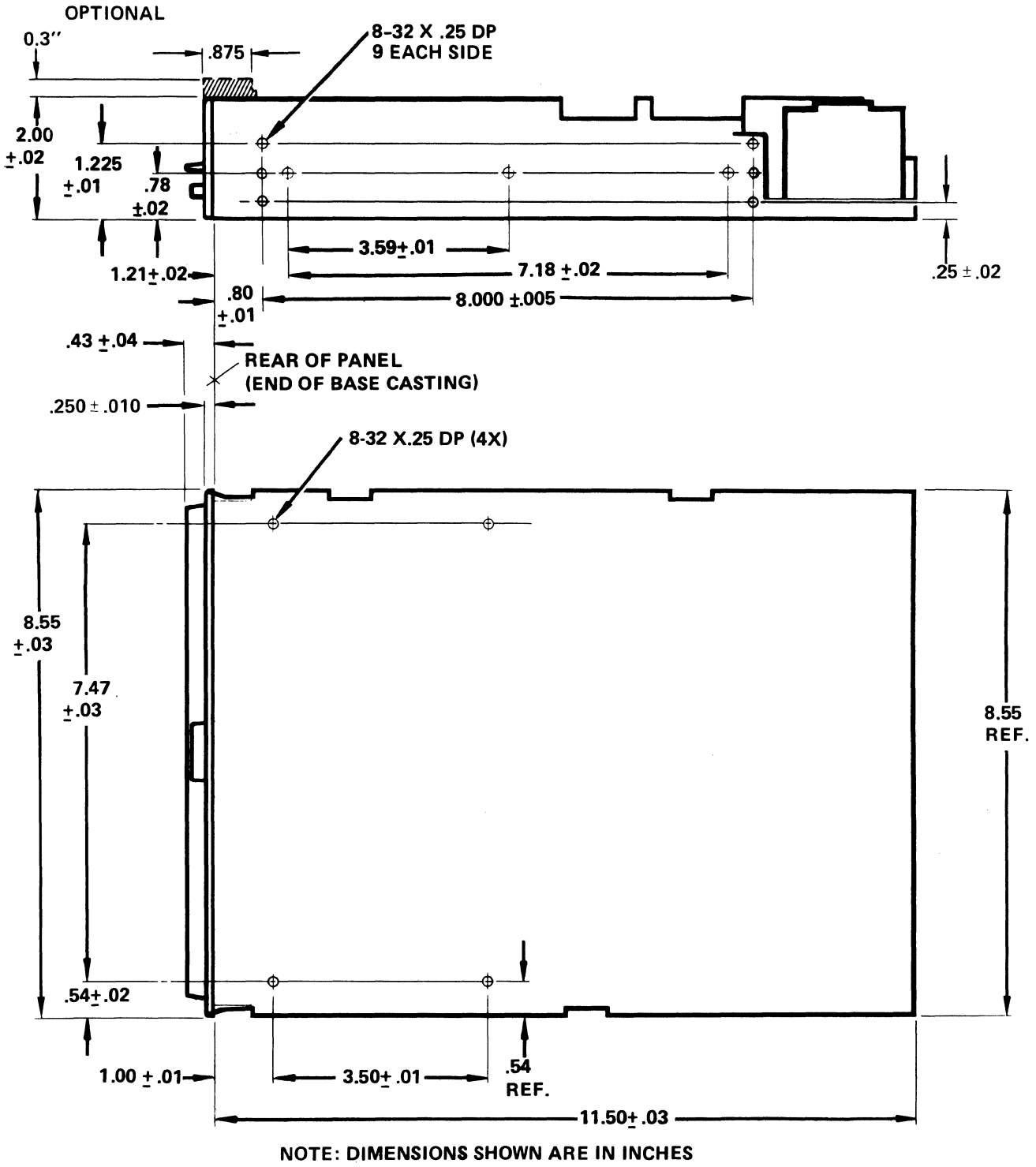
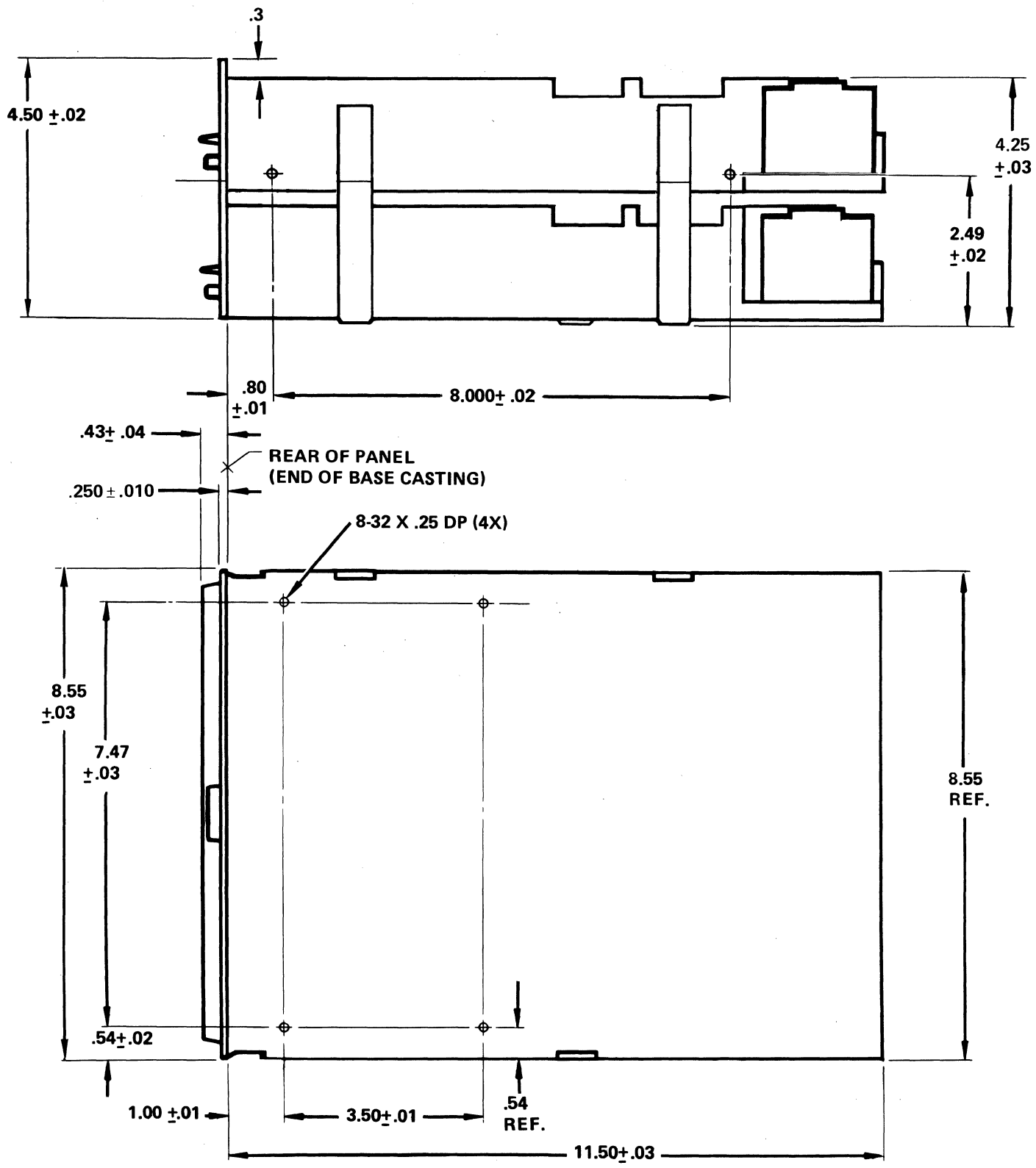
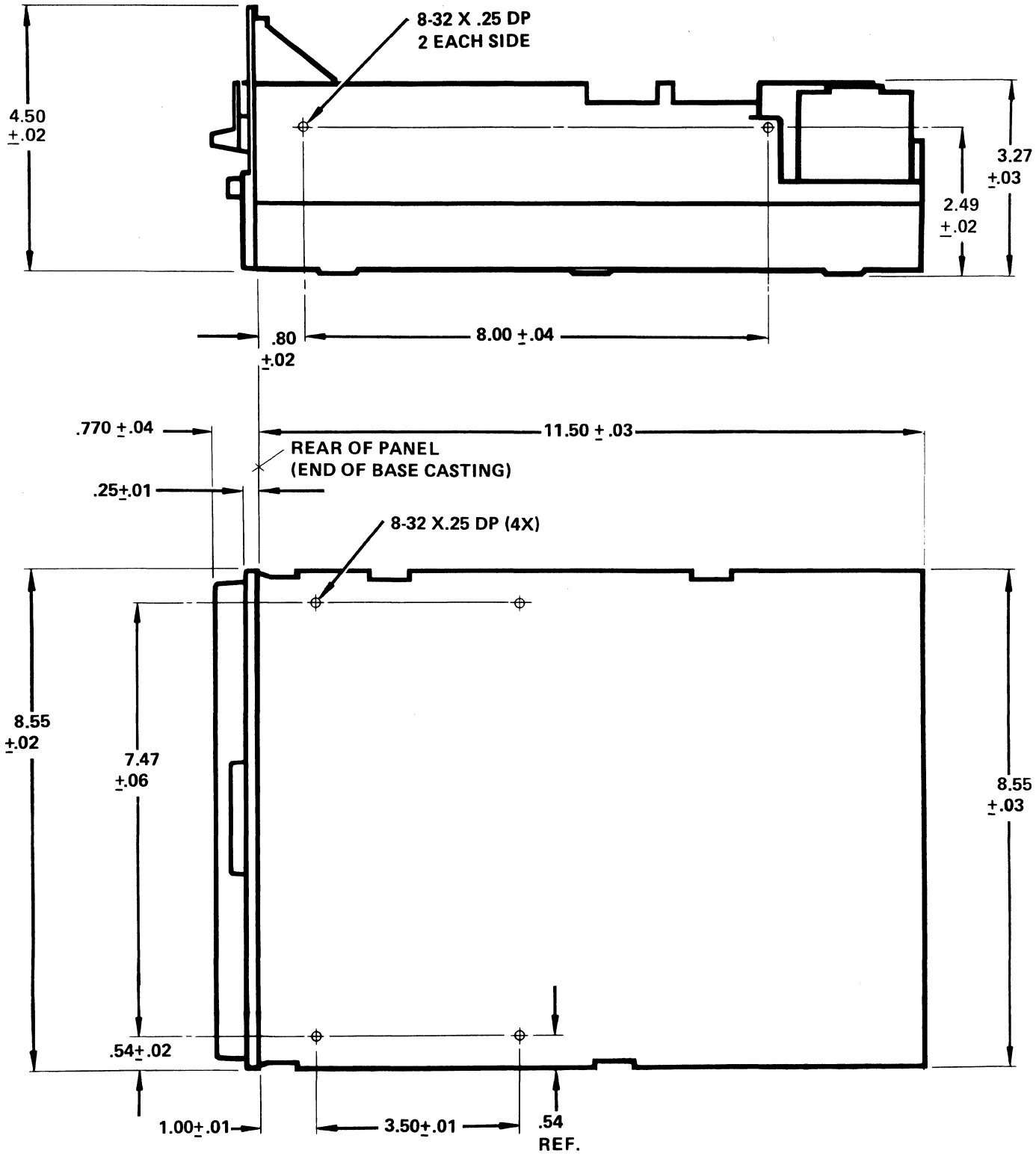


Figure 2-1: 41/42M(H) Mounting Dimensions



NOTE: DIMENSIONS SHOWN ARE IN INCHES.

Figure 2-2: 41D/42D Mounting Dimensions



NOTE: DIMENSIONS SHOWN ARE IN INCHES.

Figure 2-3: 41S/42S Mounting Dimensions

2.6 CABLE REQUIREMENTS

The electrical interface between the MPI Model 40 Series and the controller is accomplished by two connectors. The first connector, J1, is a 50 pin edge connector and provides the signal interface. The maximum cable length from connector to connector should be 10 feet (3 meters). Refer to table 2-1 for cable connector part number and attachment, and figure 3-4 for dimensions.

The second connector, J3, provides DC power to the drive and is mounted on the component side of the control electronics PCBA (refer to figure 6-1). It is a 6 pin Amp Mate-N-Lock type connector, Amp P/N 1-380999-0. The recommended mating connector, P3, is Amp P/N 1-480270-0 using pins which are Amp P/N 60619-1 (refer to figure 3-3).

Table 2-1: Recommended Connectors — P1

TYPE OF CABLE	MANUFACTURER	CONNECTOR P/N	CONTACT P/N
Twisted Pair, 26	AMP	583717-1	1-583616-5
Flat Cable	3M "Scotchflex"	3415-0001	N.A.

2.7 OPERATIONAL PROCEDURES

The MPI Model 40 Series is designed for easy operation with a wide range of operator oriented applications. The drive is under direct control of the interface and power sources. No special start-up procedures are necessary. Secure both power and I/O connectors prior to loading a diskette.

2.7.1 Diskette Loading

The diskette is a flexible disk enclosed in a plastic jacket. The interior of the jacket contains a liner which is specially designed to clean the disk. Figure 2-4 shows the proper way of loading the diskette into the drive. To load a diskette, depress the latch, insert the diskette with the label facing out and close the access door. This will align the diskette on the drive spindle. The diskette can be loaded or unloaded with power on and the spindle rotating. When not in use the diskette should be stored in the envelope.

2.7.2 Diskette Care and Handling

To get the best performance from your diskettes and to protect the information you need, it's best to keep to the following rules.

A. Return the diskette to it's storage envelope whenever it is removed from the drive.

B. Keep the diskette away from magnetic fields and from ferro-magnetic materials which might become magnetized. Strong magnetic fields can distort recorded data on the diskette. Keep diskettes away from telephones.

C. Replace storage envelopes when they become worn, cracked or distorted. Envelopes are designed to protect the diskette.

D. Do not write on the plastic jacket with a lead pencil or ball-point pen. Use a felt tip pen.

E. Do not expose the diskette to heat or sunlight or to an unclean environment.

F. Head contamination or dirt can damage the disk.

G. Do not touch or attempt to clean the disk surface. Abrasions may cause loss of stored data.

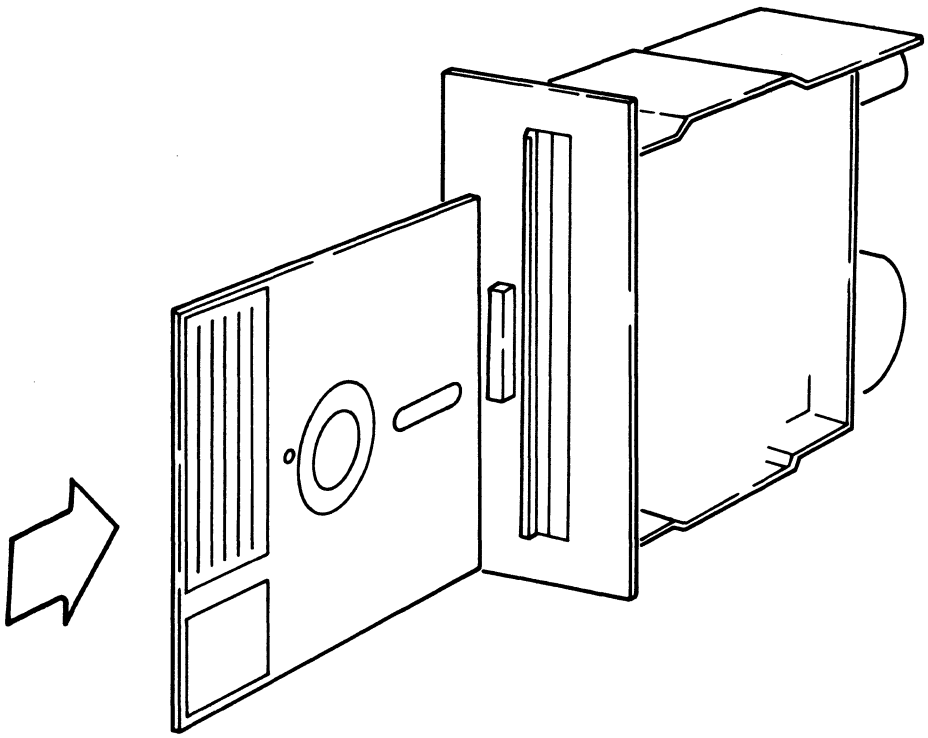


Figure 2-4: Diskette Orientation

2.7.3 Write Protected Diskette

Most diskettes today incorporate a write protect feature so your system cannot accidentally write over or destroy valuable information contained on your diskette when the write protect feature is activated.

The write protect feature is activated by the hole in the diskette as shown in figure 2-5. When the hole is opened it is write protected, when the hole is covered writing is allowed. For write enable, the hole is closed by placing a tab over the front of the hole and folding over the tab to cover the rear of the hole. By removing the tab the diskette can once again be write protected.

IBM diskettes are not manufactured with a write protect hole. To write protect one of these diskette, a hole must be punched out as shown in figure 2-6.

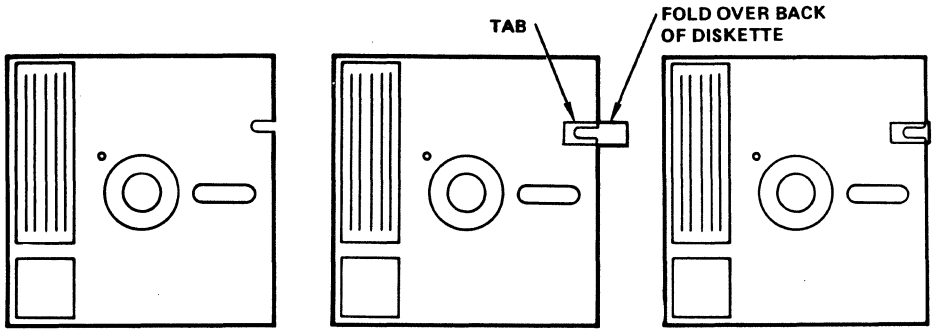
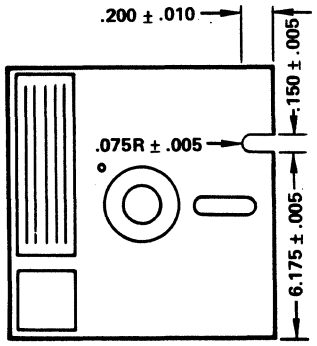


Figure 2-5: Write Protected Diskette



NOTE: DIMENSIONS SHOWN ARE IN INCHES.

Figure 2-6: Write Inhibit Notch Specifications

SECTION 3

THEORY OF OPERATION

3.1 INTRODUCTION

This section contains information on the electrical interface, diskette formatting, and an operational description of the Model 40 Series Disk Drives. The text is referenced to block and timing diagrams within this section and to detailed schematics in Appendix B. The organization of material in this section is as follows:

A. The electrical interface requirements between the host system and the Model 40 Series Drives.

B. A detailed description of the disk drive's electrical and mechanical assemblies.

C. A functional description of the disk drive.

D. Information pertaining to data encoding and recovery.

Table 3-1 is a section index and lists the topics discussed and their location within this section.

Table 3-1: Section Index

Topic	Paragraph
Mechanical Assemblies	3.2
Electro-Mechanical Assemblies	3.3
Electrical Assemblies	3.4
Electrical Interface	3.5
Functional Operation	3.6
Data Encoding and Recovery	3.7

3.2 MECHANICAL ASSEMBLIES

3.2.1 Drive Mechanism

The drive mechanism consists of an aluminum chassis and a glass impregnated plastic frame. Mounted on the chassis is a spindle and motor assembly for rotating the media; a stepper motor/band combination for positioning the magentic head(s); and a cone/clutch assembly for centering and holding the diskette under operation.

3.2.2 Door Mechanism

The door mechanism consists of the door and door button which mount within the bezel. The door is attached to two door arms which are spring loaded to keep the door in an open position when unlatched. Closing the door will cause the door arms to contact and lower the clutch arm; and partially rotate the ejector shaft to arm the ejector release mechanism.

3.2.3 Cone/Clutch Assembly

The cone/clutch, which is attached to the clutch arm, is lowered onto the spindle hub to center and clamp a diskette when the door is closed.

3.2.4 Ejector Assembly

The ejector is designed to partially push the diskette from the drive when the door is opened so it may be easily handled by the operator. The ejector block is cocked when the diskette is installed. The ejector release mechanism is armed when the door is closed by causing the ejector-spring-end to move beneath the ejector block. When the door is opened, the spring-end will trigger the ejector block forcing the diskette partially from the drive.

3.2.5 Pressure Pad Assembly

The pressure pad is designed to keep the rotating diskette from wobbling prior to passing over the read/write head(s). When the door is closed the ejector shaft will rotate causing the shaft mounted pressure pad adjustment block to force the foam rubber pressure pad onto the diskette.

3.3 ELECTRO-MECHANICAL ASSEMBLIES

3.3.1 Head Load Solenoid

The soleniod, when energized, will allow the spring tensioned load arm of the carriage to lower its felt pad (in Model 41) or upper head (in Model 42) and press on the diskette opposite the lower head. The load arm is lifted when the door is opened even if the solenoid is energized.

3.3.2 Head/Carriage Assembly

The carriage assembly consists of a fixed lower read/write head and a spring tensioned load arm with either a felt pad (in Model 41) or a second read/write head (in Model 42) on its end. When loaded by the head load solenoid it will apply about 20 grams of pressure on the diskette opposite the lower head. The carriage assembly slides on highly polished guide rods when moved by the stepper motor/band assembly.

3.3.3 Stepper Motor/Band Assembly

The read/write head(s) are accurately positioned by a stepper motor and metal band mechanism. The stepper motor is a 100 pole 4 phase motor which, when not in a stand-by mode, always has two adjacent phases energized. Each stepping pulse de-energizes one phase and energizes another, thus rotating the stepper motor by 3.6°. This rotary motion is translated by the pulley on the shaft of the stepper motor and the flexible stainless steel band which encircles it into the proper amount of linear motion necessary to reposition the read/write heads by precisely one track.

3.3.4 Spindle And Motor

The spindle motor is mounted at the rear of the drive and transfers its rotary motion to the spindle pulley by a drive belt. This causes the diskette to be rotated at 360 RPM. It is held against the hub by the diskette clamp, which contains a registration cone. This cone, located opposite the spindle face, serves to center the diskette on the spindle hub.

3.3.5 Door Lock Mechanism

The user can lock and unlock the drive door by controlling the solenoid within the door lock mechanism. When energized, it causes the mechanism's actuator to interfere with normal door opening movement. When de-energized, movement is unrestricted; the door is unlocked. In its standard configuration, the door is locked whenever the drive is selected.

3.4 ELECTRICAL ASSEMBLIES

3.4.1 Control Electronics PCBA

All the electronics except the Spindle Motor-Servo control are placed on one printed circuit board which contains the following items. Also, this PCBA has many configuration jumpers which allow the user to tailor the drive's operation to his needs. These jumpers are discussed in section 6 of this manual.

A. Index demutliplexing circuit for hard sectored diskettes.

B. Stepper motor driver and direction select circuit.

C. Head load solenoid driver.

D. Read and write channels.

E. FM Data and clock separator.

F. Write protect.

G. Ready status detector circuit.

H. Drive select circuit.

I. Side select circuit.

J. In use and door lock circuit.

K. Track 00 and track 43 detector circuit.

L. Power On reset.

3.4.2 Spindle Servo PCBA

The spindle servo PCBA is a separate circuit board located at the right rear of the drive above the diskette plane. The servo provides a ground path for the +24v on the spindle motor. The motor, when rotating, is monitored so that motor current can be controlled (refer to paragraph 3.6.4). The spindle speed control servo maintains the rotating speed of the motor within 1-1/2% of its nominal speed.

3.4.3 Write Protect Sensors

Two sensors are used for the write protect feature of the drive. Sensor information is sent to the control electronics PCBA. If both sensor light paths are blocked, writing is permitted. But if one sensor's light path is blocked and the others is unobstructed, then writing on the diskette installed is not permitted.

Normally the sensor on the left side of the drive (as viewed from the front) is all that is needed. But as a result of the "flippy" option (which allows a dual sided diskette to be used in a single head machine) a dual sensor system is required.

3.4.4 Track 00 And Track 43 Sensors

These sensors are used to convey head position to the controller through the control electronics PCBA. By monitoring these two sensor outputs, head position can be determined to be at track 00; between track 00 and 43; at track 43 or greater.

3.4.5 Index Sensor

The index sensor is mounted on the bottom of the drive and is used to inform the control electronics PCBA when the index hole in the diskette is present. The index hole is used to reference the beginning of a track. The index period is also used to determine whether the diskette is rotating at its nominal speed. If the diskette is not up to speed, in the standard configuration the head will be unloaded and the not ready signal will be sent to the controller.

3.4.6 Activity Indicator

The activity indicator is an LED which is mounted in the drive bezel. This LED is illuminated by the control electronics PCBA when the drive has been selected.

3.4.7 Read/Write Heads

The Model 41 has a single read/write head for the lower diskette surface only. This head is held in the carriage in a fixed attitude, and its surface has a spherical contour. In this model, when the head load solenoid is activiated, a pressure pad applies a gentle (20 grams) force which pushes the diskette against the head.

On the Model 42 drive, the pressure pad is replaced by a second read/write head which is mounted on a gimbal spring, and is therefore allowed to change its attitude as required to minimize both head and media wear. On this model, both heads have a special "blended" contour which also helps reduce wear. In both cases, the read/write heads are single element ceramic heads with tunnel erase elements to provide erased areas between adjacent data tracks. Without this erase capability, interchange tolerances between media and drives can degrade the signal to noise ratio. Thus the erase mechanism significantly enhances diskette interchangability.

3.5 ELECTRICAL INTERFACE

Interface connections are made thru two cables, the power cable and signal or I/O cable. The following paragraphs will describe each line on the interface cable. Refer to figures 3-2 and 3-3 for connector pin assignments, and figure 3-4 for connector dimensions.

The signal interface can be divided into two groups:

A. Control signals

B. Data transfer

All lines on the signal interface are digital (TTL open collector) in nature and provide either input signals to the drive or output status and data to the controller. Each line is paired with a ground line. All output lines are open collector outputs and must be properly terminated at the controller end. The signal interface cable should be a 50 wire flat ribbon cable no more than 10 feet in length.

Figure 3-1 is the recommended driver/receiver circuit for all interface signals (connector J1). A signal on an input line will be received by a 74LS14 receiver at the drive and should be driven by a 7438 driver or equivalent by the user system. Likewise, an output signal from the drive will be driven by a 7438 and should be received by a 74LS14 or equivalent at the user system. All input signals are terminated directly by either a 150 ohm to +5v or a 220/330 ohm resistor network.

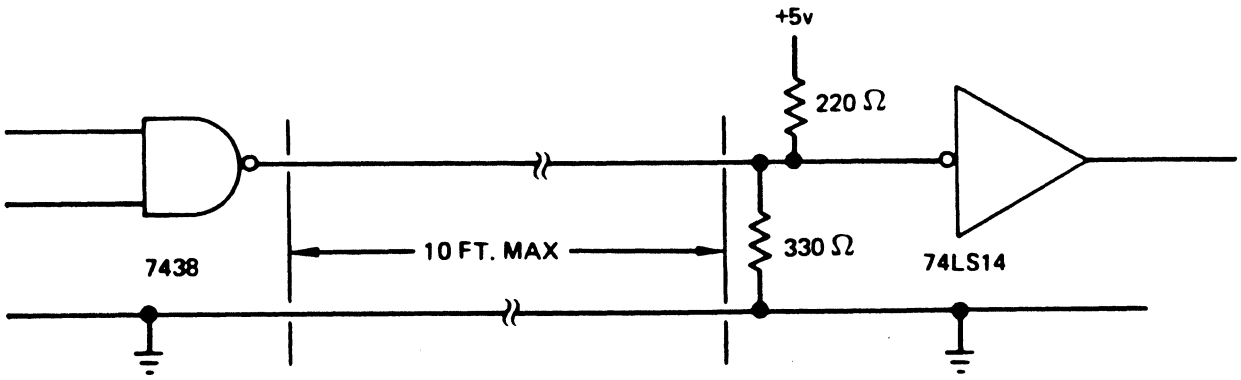


Figure 3-1: Control Signals Driver/Receiver Combination

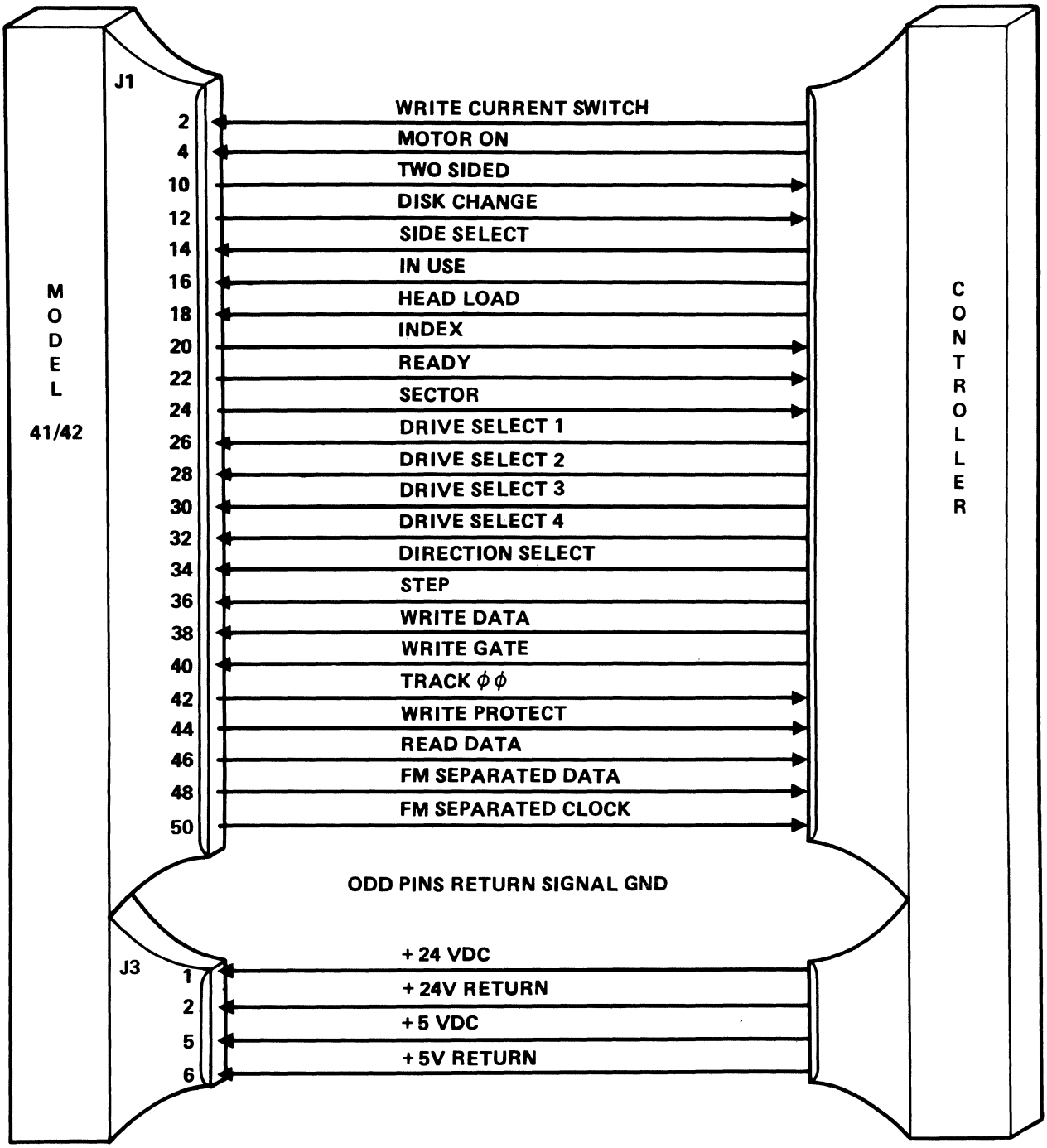


Figure 3-2: Interface Connections

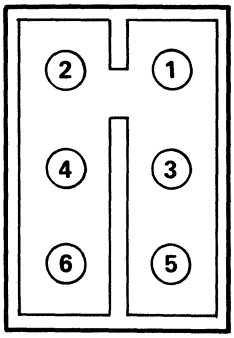


Figure 3-3: P3 Connector

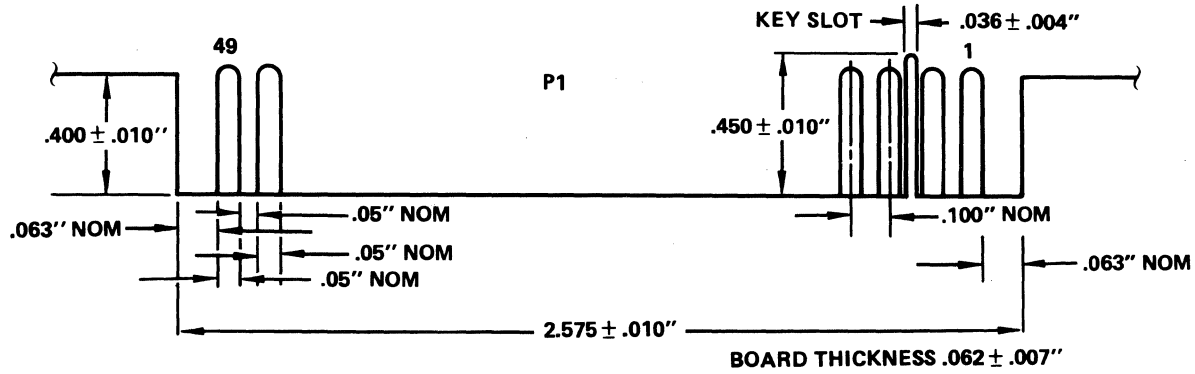


Figure 3-4: J1 Connector Dimensions

3.5.1 Input Lines

There are thirteen signal input lines; ten are standard and three are user installable options. In multiple drive systems all input lines will go to all drives but only the selected drive will respond to these signals. A drive can be selected by a user assigned jumper installation in the drive and by activating the corresponding Drive Select input line. In multiple drive systems using daisy chain connections, all input lines should be terminated only at the last drive, while in star scheme connections, each drive should be terminated properly. Input signal lines have the following specifications:

A. Active or true = logical zero (0.0V to .4V)

B. Inactive or false = logical one (2.5V to 5.25V)

C. Input impedance = 150 ohm or 132 ohm for 220/330 termination.

3.5.1.1 Motor On

In the standard configuration the spindle motor runs as long as power is applied. The motor may be turned on and off by the user by controlling the optional MOTOR ON signal line (refer to paragraph 6.7).

When MOTOR ON is activated (logical zero) the spindle motor is enabled in all drives attached to the interface cable. The rotational speed of the motor is controlled by a closed loop servo which requires some time to achieve the desired speed. Therefore, for proper functioning a 500 ms minimum delay after MOTOR ON becomes active is required prior to read/write operations. Refer to Figure 3-5.

3.5.1.2 Drive Select 1 - 4

Each of the DRIVE SELECT lines, when activated (logical zero), selects the drive which has the corresponding drive select jumper in place. In the standard configuration, the activation of this line will load the read/write heads, enable the stepper motor, enable the output lines, and light the activity LED. Only the selected drive will respond to the input lines.

Four separate DRIVE SELECT lines are provided so that up to four drives may be connected to a single controller. Jumpers B11 - C11, B12 - C12, B13 - C13, and B14 - C14 correspond to DRIVE SELECT 1, 2, 3, and 4, respectively. By placing only one of these jumpers in each drive, only one drive will be selected when activating any one of the DRIVE SELECT lines.

3.5.1.3 Side Select

This line is used in the Model 42 which utilizes double sided diskettes. A logical one on the SIDE SELECT line selects the read/write head on the lower side (side 0) of the diskette while logical zero selects the upper side (side 1) read/write head. When switching from one side to the other, a 100 us delay is required prior to any read or write operation. Refer to Figures 3-5 and 3-6.

3.5.1.4 Direction Select

This input line controls the direction the read/write heads will move when the STEP line is pulsed. A logical one on this line when the STEP line is pulsed moves the read/write heads away or "out" from the center of the diskette. A logical zero with pulse(s) on the STEP line moves the heads "in" or toward the center of the diskette. Refer to Figures 3-5 and 3-7.

3.5.1.5 Step

This input line is normally in the inactive state (logical one). Each pulse causes the read/write heads to move one track "in" or "out" from the present position, depending upon the status of the DIRECTION SELECT line as explained in paragraph 3.5.1.4. The access motion is initiated on the trailing edge or low to high transition. Any change in the DIRECTION SELECT line must be made at least 200ns before the trailing edge of the STEP pulse. Figure 3-7 shows the timing for STEP pulses.

3.5.1.6 Write Gate

The active state (logical zero) of this line enables data to be written on the diskette. The inactive state (logical one) allows for a "read" operation and enables the stepper logic. Figure 3-8 shows the timing constraints for a "write" operation.

3.5.1.7 Write Data

This input, together with WRITE GATE (active low), provides the data to be written on the diskette of the selected drive. The data should be encoded (FM or MFM) prior to sending it to the drive. Each transition from high to low on this line will reverse the write current in the read/write head thereby writing a data bit. In the selected drive, the WRITE GATE line enables this input line. See Figure 3-8 for timing.

3.5.1.8 Head Load (Alternate Input)

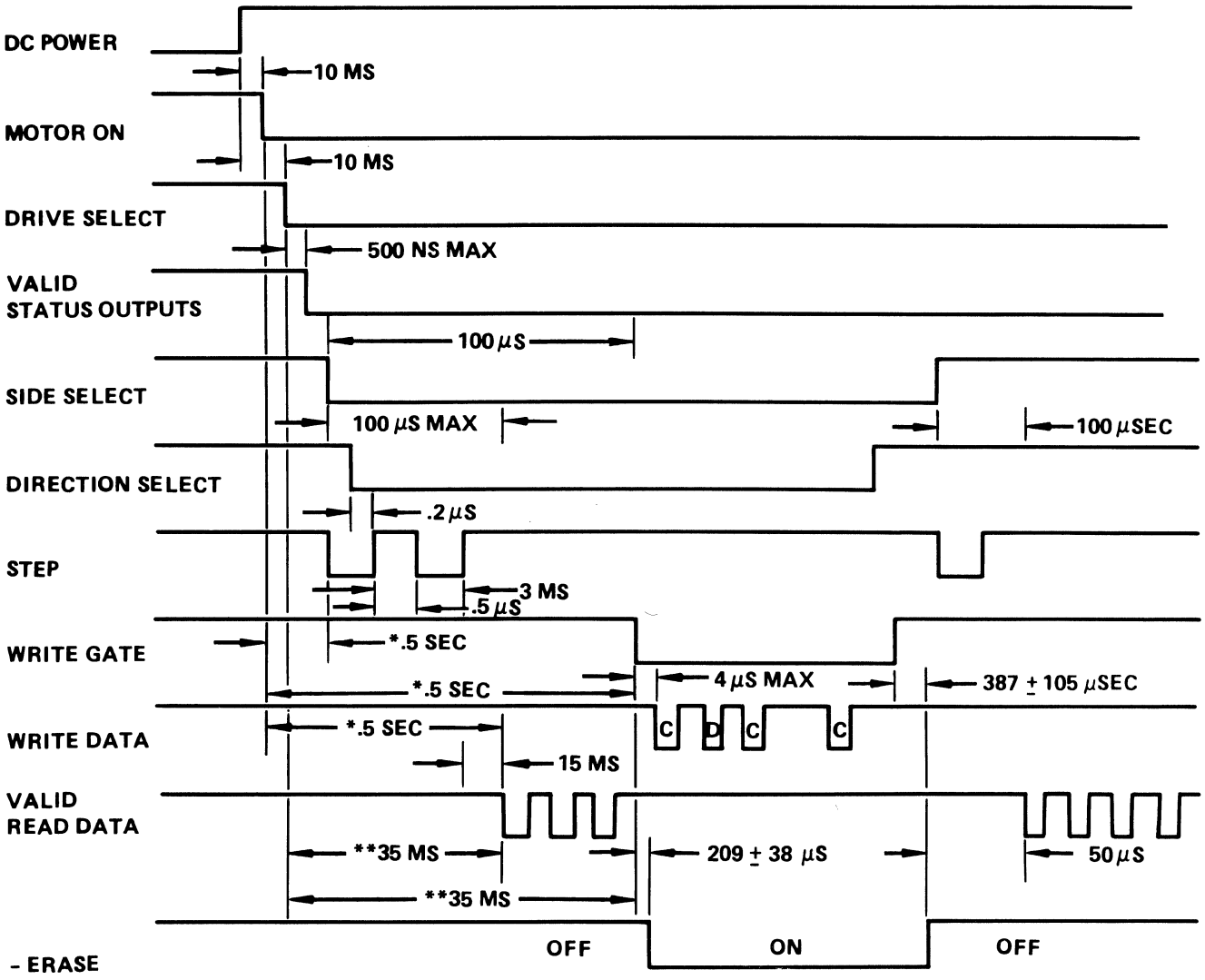
This input line is a user installable option which is enabled by jumpering C3 - C4 in the drive. When this option is used and activated (logical zero) and the drive is ready, the read/write heads will be loaded against the diskette. Refer to paragraphs 6.3 and 6.4 for installation and a detailed description.

3.5.1.9 In Use (Alternate Input)

This input line has been designated a spare I/O pin.

3.5.1.10 Write Current Switch (Alternate Input)

This input line is a user installable option enabled by jumpering J12 - K12 in the drive. This input line is an alternate function with the Track 43 Internal Sensor signal in the drive. When active (logical zero), this input line lowers the write current for tracks 43 thru 77. Inner tracks have more flux reversals per inch than that of outer tracks which requires lowering the write current for the inner tracks. Refer to paragraph 6.8.

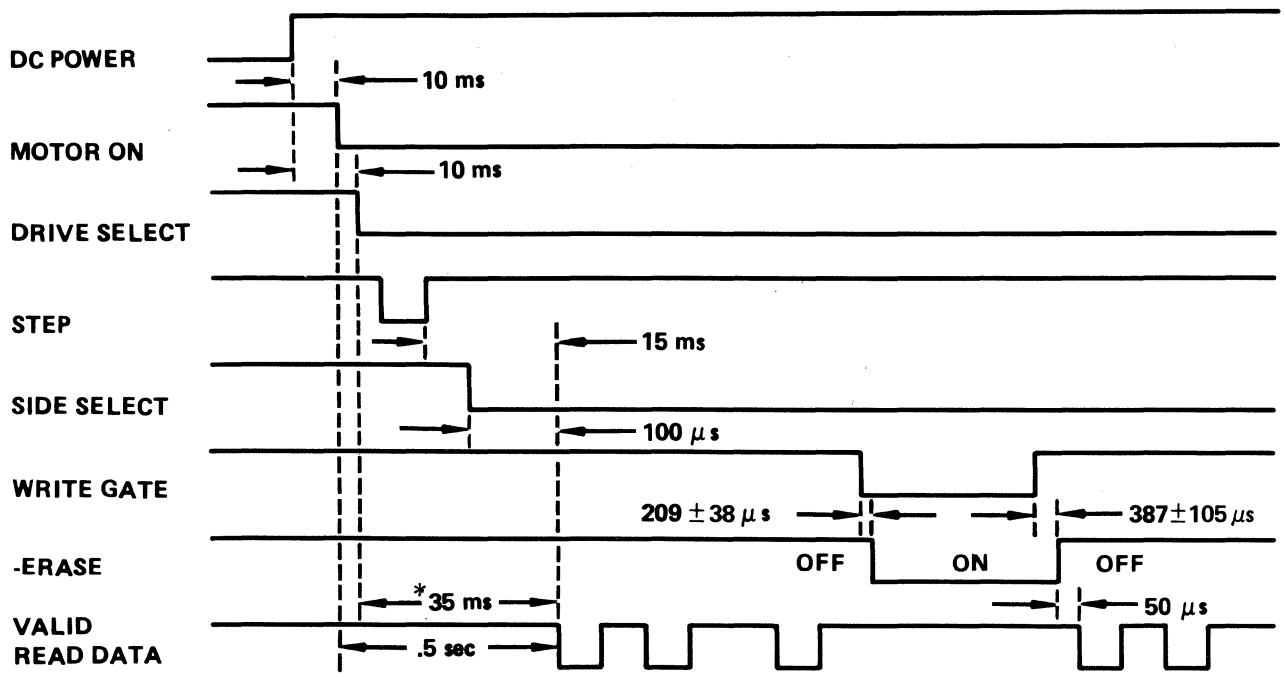


*A .5 SEC MIN DELAY IS REQUIRED AFTER THE MOTOR ON LINE IS ACTIVATED.

**THIS DELAY IS NECESSARY IF DRIVE SELECT IS USED TO LOAD HEADS. OTHERWISE A 35 MS MIN DELAY IS REQUIRED AFTER THE HEAD LOAD LINE BECOMES ACTIVE. IF HEAD LOAD IS NOT USED TO ENABLE THE STEPPER MOTOR THEN A 15 MS MIN DELAY IS REQUIRED FOR STEPPER SETTING AFTER ENABLING THE STEPPER MOTOR.

NOTE: TIMES SHOWN ARE MINIMUM TIMES EXCEPT AS NOTED.

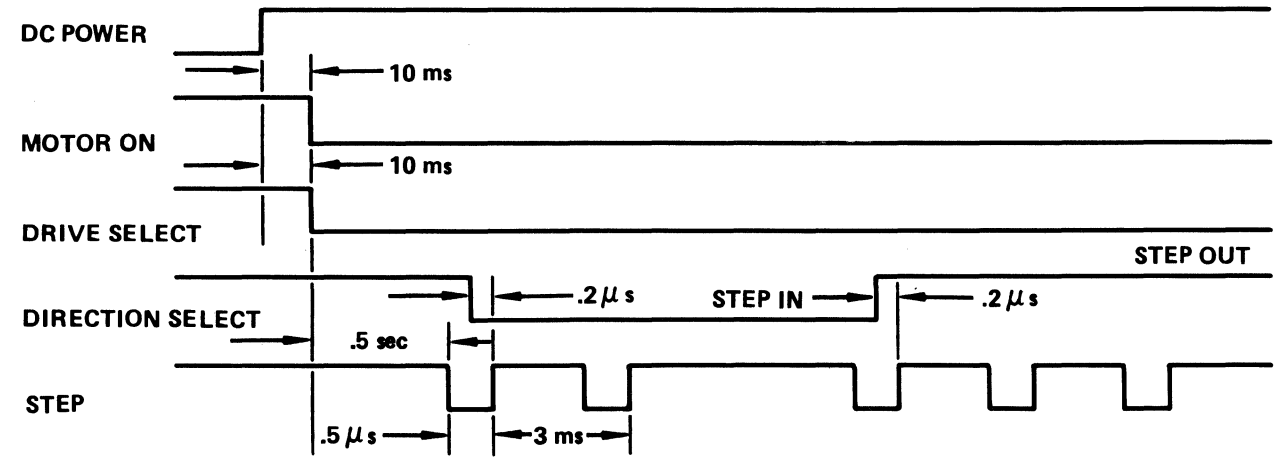
Figure 3-5: General Control and Data Timing Requirements



*IF HEAD LOAD LINE IS USED TO LOAD HEADS THEN 35ms DELAY IS FROM ACTIVE HEAD LOAD LINE.

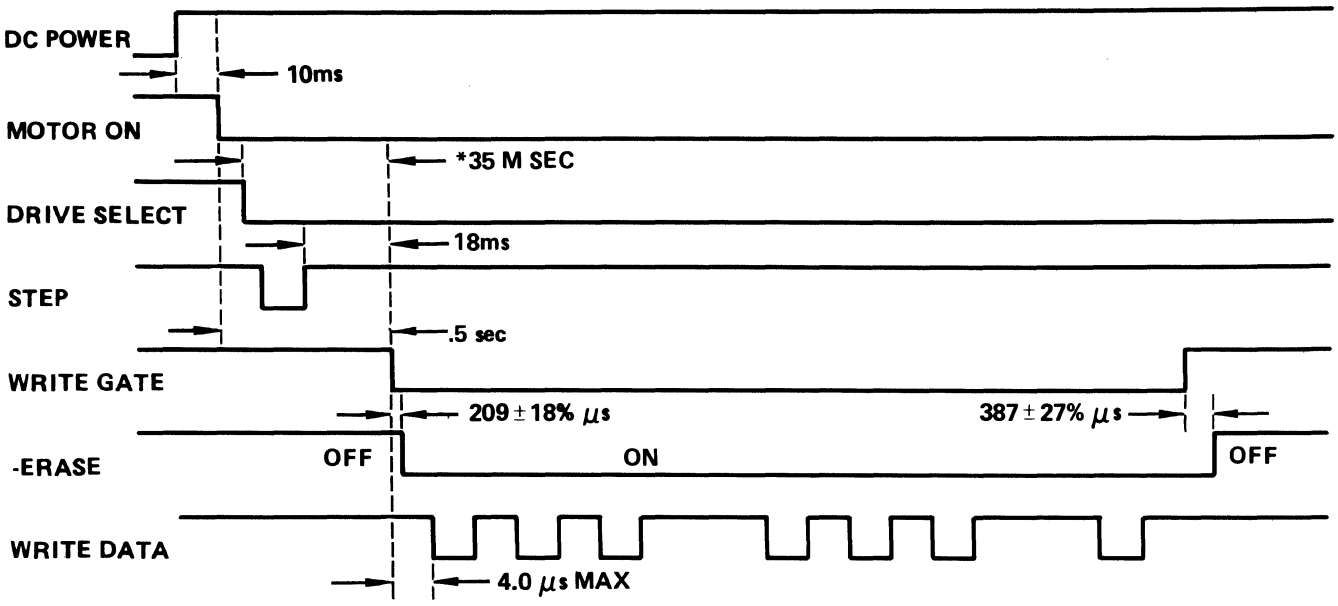
NOTE: TIMES SHOWN ARE MINIMUM TIMES EXCEPT AS NOTED

Figure 3-6: Read Initiate Timing



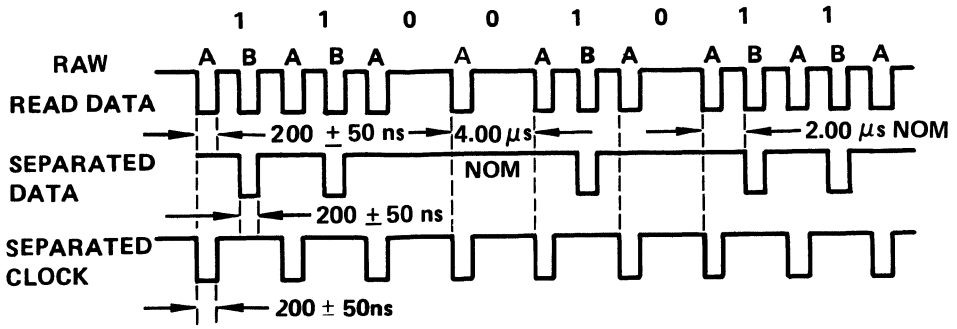
NOTE: ALL TIMES SHOWN ARE MINIMUM TIMES

Figure 3-7: Initialize and Track Access Timing



*IF HEAD LOAD LINE IS USED THEN 35ms DELAY IS FROM ACTIVE HEAD LOAD LINE.
NOTE: TIMES SHOWN ARE MINIMUM TIMES EXCEPT AS NOTED.

Figure 3-8: Write Initiate Timing



A = LEADING EDGE OF BIT MAY BE ± 400ns FROM ITS NOMINAL POSITION.
B = LEADING EDGE OF BIT MAY BE ± 200 ns FROM ITS NOMINAL POSITION.

Figure 3-9: Read Signal Timing for FM Recording

3.5.2 Output Signals

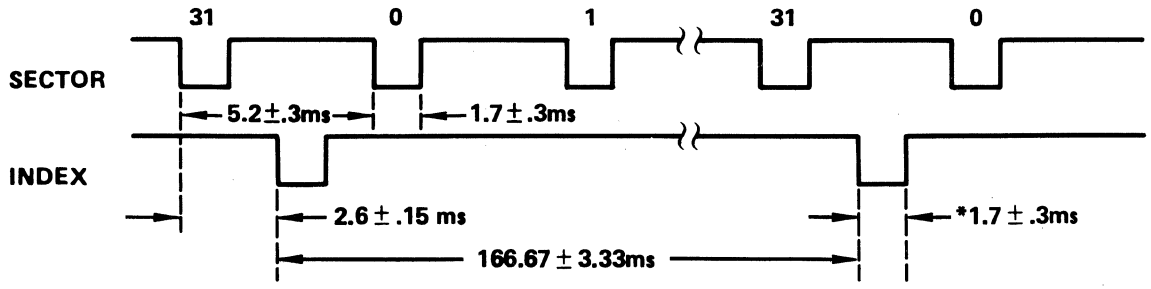
There are six standard output lines and four optional output lines. All output lines are driven with open collector output stages capable of sinking a maximum of 48ma at a logical zero level (0V to .4V) at the driver. When the driver is at a logical one level (2.5V to 5.25V), the collector current is a maximum of 250 ua. All the output lines are controlled by DRIVE SELECT and only the selected drive sends its outputs to the host.

3.5.2.1 Track 00

This output line when active (0V to .4V) indicates the drive's read/write heads are positioned at the outermost track, and is normally used to reset the step counter in the controller and initialize the step operation. Prior to any read/write operation, to initialize read/write position with respect to data tracks, a "STEP OUT" operation must be performed until the TRACK 00 interface line becomes active. Refer to Figure 3-7.

3.5.2.2 Index

This output line sends a pulse to the controller which indicates the beginning of a track on each revolution of the diskette. Normally, the INDEX pulse is a negative going pulse with a period of 1.7ms $\pm$ 0.3 ms. For a hard sectored diskette, the INDEX signal is demultiplexed from the sector pulses and the pulse width is 1.2ms $\pm$ 0.68ms. Refer to Figure 3-10 for Index timing.



*FOR HARD SECTORED DISKETTE INDEX PULSE IS 1.2ms $\pm$ .68ms WIDE

Figure 3-10: Index and Sector Timing

3.5.2.3 Sector

This output line sends SECTOR pulses when a hard sectored diskette is installed. Normally there are 32 sector holes in the diskette, so there are 32 negative going pulses each with a period of 1.7ms $\pm$ 0.3ms. The INDEX pulse is exactly halfway between SECTOR pulses 31 and 0. The leading edge should be used for reference. See Figure 3-10 for timing.

3.5.2.4 Ready

This output line indicates that the spindle is spinning at more than 80% of its normal speed, a diskette is in place, and at present speed at least two INDEX pulses have been sensed. If a single sided diskette is used READY will be active if side 0 is selected, but false if side 1 is selected. There is an option available which allows double sided diskette to be used in a single sided drive which is called the "flippy" option.

3.5.2.5 Read Data

This output line provides the raw data (clock and data combined) as detected by the read/write heads. When the drive is not in a write mode and all other timing requirements are met, then and only then will valid READ DATA be sent. See Figure 3-6 for the timing requirements. For every flux change on the diskette, READ DATA will send one negative going pulse on this line.

3.5.2.6 FM Separated Data (Optional Output)

This optional output line provides separated data bits from raw READ DATA in FM encoding only. The drive has an internal FM data separator. See Figure 3-9 for separated data bit timing. The FM data separator can provide separate data and clock information for soft-sectored standard IBM format and address mark areas.

3.5.2.7 FM Separated Clock (Optional Output)

This optional output line provides a CLOCK separated from FM raw READ DATA using an internal data separator. Refer to Figure 3-9 for timing.

3.5.2.8 Write Protect

This output line becomes active when a write protected diskette is installed which indicates that the user should avoid writing on that diskette. In the standard configuration, when this line

is active it disables the write operation. For single sided drives (Model 41), a "flippy" option for write protect is available which allows double sided diskette usage in single sided drives.

3.5.2.9 Disk Change (Optional Output)

This is an optional output which becomes true (logical zero) in the selected drive when the READY signal goes false. This line is reset either when the drive goes ready again or when it is deselected.

3.5.2.10 Two Sided (Optional Output)

This is an optional output which becomes true (logical zero) in the selected drive when a two sided diskette is installed and at least one INDEX pulse is sensed. The Model 42 utilizes double sided diskettes.

3.5.3 Alternate I/O Pins

In the standard configuration there are unused pins available for the optional configration of the drive as mentioned in Section 6, OPTIONAL CONFIGURATION. Pins 2,4,6,8,12,16,18,24,28,30,32,48 and 50 on connector J1 are unassigned in the standard configuration.

3.5.4 Power Interface

The Model 40 Series requires DC power of +24V and +5V. +5V is used for the electronics and +24V is used for the stepping motor, spindle drive motor, write current, and the door lock and head load solenoids. See Figure 3-3 for the connection, and Table 3-2 for pin assignments. The MPI Model 40 Series does not require AC power, so an AC power connector and 50/60 HZ adjustments on the pulley and belt are not required.

Table 3-2: Connector P3, Pin Assignments

P3 Pin	DC Voltage	Tolerance	Current	Max Ripple
1	+ 24 VDC	± 10%	1.25A typical	100 mv P - P
2	+ 24 VDC Return			
5	+ 5 VDC	± 5%	1.00A typical	50 mv P - P
6	+ 5 VDC Return			

3.6 FUNCTIONAL OPERATIONS

3.6.1 Initialize

The Model 41/42 requires only two DC voltages for proper operation: + 24V ± 2.4V DC and + 5V ± 0.25V DC. After power is applied, it is necessary to wait about 500 ms before the drive enters a ready condition. The READY output (P1-22) will go active after the 500ms delay and the drive has been selected signifying that the read/write operation may begin. This time is required to start the motor and lock it to the specified rotational speed. The motor is started whenever the MOTOR ON signal is sent to the spindle servo PCBA. This is accomplished upon power up in the standard drive as jumper B2-C2 places a ground on U28-9 which causes MOTOR ON to go active.

With the spindle rotating and a diskette installed, the INDEX signal (page 3, area D7) is monitored to determine when the diskette has reached its nominal rotational speed. This is accomplished by the retriggerable single-shot (U32-12) and the two D-type flip flops (U33-11, 3) which are clocked on each INDEX signal (area D6). If the diskette is rotating at sub-nominal speed the single-shot (U32-10) will toggle and keep the two flip flops in a reset condition. Once nominal speed has been reached, the single-shot will cease toggling and two INDEX signals will be counted, leaving both flip flops set and the drive in a ready condition (U37-6 will be high; area D5).

Prior to the first read/write operation, a "step out" operation must be performed until the TRACK 00 interface line (P1-42) becomes active to initialize carriage position. Refer to figure 3-7.

When power is first applied the power up reset circuit, consisting of U10, R33, R34, and C25 (page 3, area C7), resets the stepper phase selection flip flops, U7 (area C6), causing pins 6 and 8 to go high. This will enable stepper motor phases one (J4-2) and four (J4-1) (page 3, area B2) and partially enable the Track 00 gate, U15 (area C5). If the carriage was positioned at track zero, J5-12 (area C8) would go high causing U15-8 to go high; sending the TRACK 00 signal.

The MPI Model 40 Series provides a diskette in-place sensor, rather than a Door Closed Switch. The drive can be ready and heads can be loaded if the diskette is installed, the door is closed, and the spindle is rotating at its nominal speed.

3.6.2 Drive Selection

There are four DRIVE SELECT interface lines (page 3, area A8) available to the controller. Also, there are four jumper lines available on the drive. By jumpering these lines, one per drive, any one of four drives can be selected by activating the corresponding DRIVE

SELECT interface line. Only the selected drive will respond to the controller commands for action or provide drive status to the controller. In standard operation, activating DRIVE SELECT will load the read/write heads, enable the stepper motor, enable input and output interface lines, turn on the activity indicator and lock the door.

In the standard drive, DRIVE SELECT 1 is enabled by jumper B11-C11. DRIVE SELECT 1 will cause U37-3 (page 3, area A7) to go low, which through jumpers L21-L22, L19-L20, and L18-M18 cause U29-6 (area B6) to go high loading the head and enabling the stepper motor (area B2) with K9-K10 installed. The output status lines are enabled by a high on U36-1 (area C5); the door is locked and the activity indicator is illuminated by a low on U21-2 and 7 (area B2) which can be traced back to a high on U20-3, and jumper J8-J9 (area B5) respectively.

3.6.3 Track Positioning

After initializing to Track 00 with DC power on, as discussed in paragraph 3.6.1, the read/write heads can be positioned on any desired track by:

A. Activating the proper DRIVE SELECT line.

B. Selecting the desired direction using the DIRECTION SELECT line.

C. Pulsing the STEP line.

Each pulse on the STEP line (P1-36) will cause the read/write heads on the selected drive to move one track forward or reverse, depending on the DIRECTION SELECT line (P1-34). By repeatedly pulsing the STEP line, consecutive tracks can be accessed. At the track zero position the stepper phase selection flip flops (U7) (area C6) are both reset enabling stepper motor phases one and four. The "D" inputs to both flip flops are fed by separate gate, U26 (area C6). These gates sample the flip flop outputs and the condition of DIRECTION SELECT. The STEP signal clocks both flip flops as an output of U31-8 (area B-6), which is enabled by WRITE GATE (P1-40) being false (high). Refer to figure 3-11 for timing characteristics. During the write operation track positioning is inhibited. Head movement is initiated on the trailing edge of the STEP pulse. See Figure 3-7 for timing constraints.

3.6.3.1 Step Out

When the DIRECTION SELECT line is inactive, or false (+ 2.5V to 5.25V), a pulse on the STEP line will cause the read/write heads to move one track away from the center of the disk (out). The DIRECTION SELECT and STEP lines must have the timing characteristics shown in Figure 3-7.

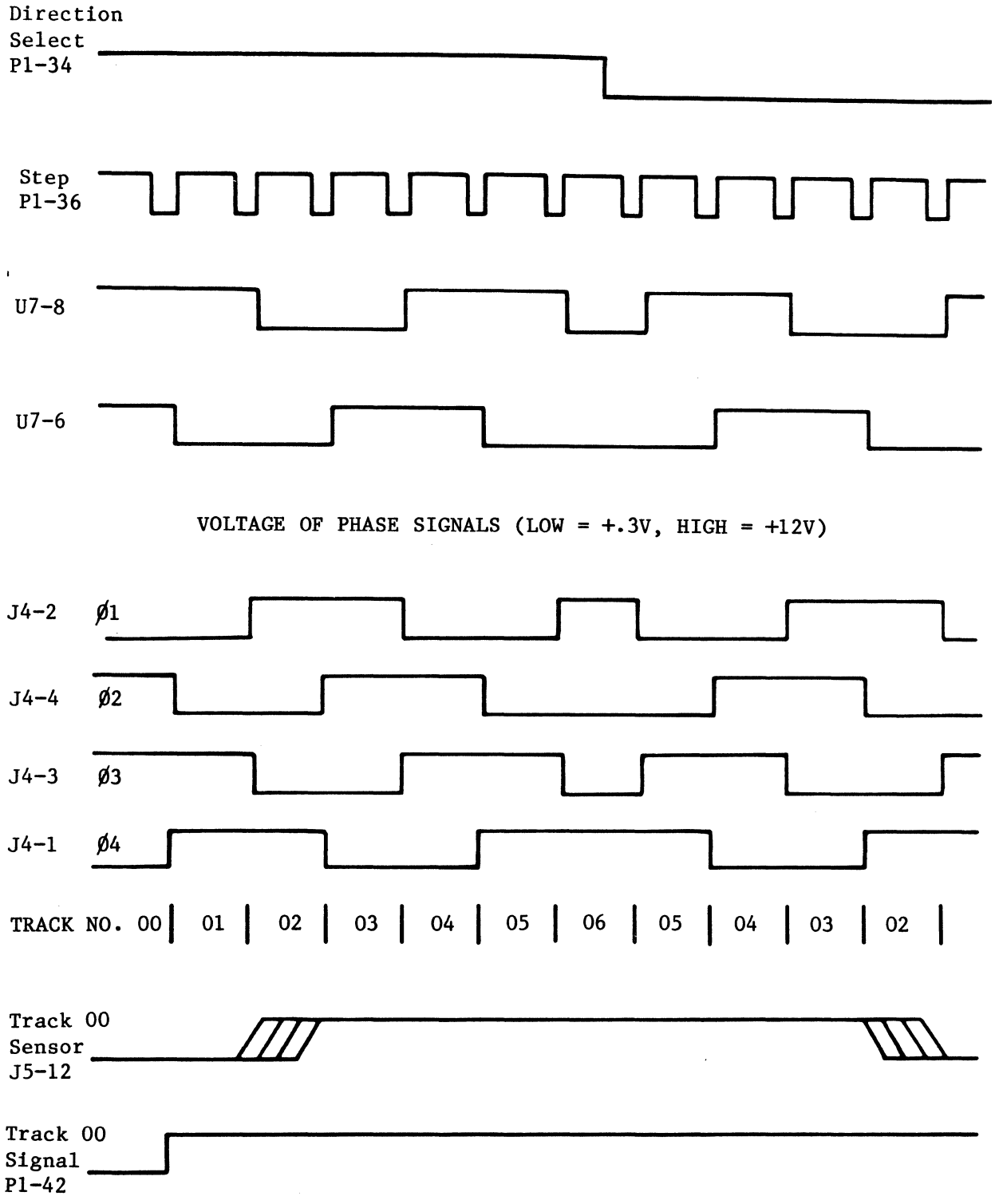


Figure 3-11: Stepper Motor Timing

3.6.3.2 Step In

A true level (0V to .4V) on the DIRECTION SELECT line along with pulse(s) on the STEP line will move the read/write heads towards the center of the disk.

3.6.4 Spindle Speed Control

The spindle servo electronics are mounted on a separate circuit board located at the right rear of the Drive above the diskette plane. When the MOTOR ON signal becomes active (logical zero), transistor Q1 (page 1 area B7) is turned off and Q2 is turned on, gating +24V to one side of the spindle motor coils.

Transistors Q3, Q4, Q5, and Q6 when turned on simply provide a ground path for the +24V on the other side of the coils. Only one of these transistors is turned on at a time. They are enabled by the signals HE1, HE1, HE2, and HE2 which control the base of the transistors through the diodes in parallel. When both diodes in parallel are reversed biased, the transistor sends a ground to one side of the coil and the motor moves to that phase. When the enabled phase is reached, it will be disabled and the next phase enabled; this causes the motor to rotate. The four control signals keep changing states by the "Hall Effect" sensors mounted internal to the motor. The four comparators of U2 compare the sensor outputs and develop the control signals.

As the motor rotates, HEI is used to generate a pulse train at U1-1 which, in turn, creates a voltage level at the charge pump. This voltage is compared with a reference voltage at pin 10 and if it is less than the reference voltage, the motor current will be increased by allowing U1-8 to go more positive to the base of Q2 so that the spindle speed will be increased. If the motor is running too fast, then the charge pump voltage will exceed the reference voltage (U1-10) and the motor current (U1-8) will be cut off which in turn will reduce the spindle speed. The spindle speed control servo maintains the rotating speed of the motor within 1-1/2% of its nominal speed.

3.6.5 Side Selection

In a standard two sided drive, head selection is controlled by the SIDE SELECT interface line (P1-14; page 3, area C8). A false or high level (2.5V to 5.25V) on the SIDE SELECT line will select the read/ write head on the lower side (side 0) of the disk and a true or low level (0V to .4V) on the SIDE SELECT line will select the read/ write head on the upper side (side 1) of the disk. SIDE SELECT is inverted by U27-8 (page 3, area C7) and routed to page 2, area C8 as + Side Select. When selecting head Ø, the + Side Select signal would be a low level. Through inverter U20-8, it is ANDed with + Erase to turn on the erase circuit for head Ø. The high level at U20-8 (area B8) is sent through open-collector U1-10

(area B7) and a positive voltage greater than +6V is placed on pin 13, the base of the head Ø enable transistor. This transistor gates a positive voltage to the center top of head Ø to enable it. The base of the head 1 enable transistor, pin 10 (area C6) would be low at this time which would reverse bias the transistor and cause a ground to be sent to the center tap of the head 1 to disable it. Changing polarity of the SIDE SELECT signal changes the polarity of the center taps of both heads. When switching sides from one to the other after the SIDE SELECT line changes state, a 100 us delay is required before read or write operation can be initiated. Figure 3-6 shows the use of SIDE SELECT prior to a read operation.

3.6.6 Write/Erase

Encoded (FM or MFM) data will be written on the disk by:

A. Selecting the proper drive.

B. Selecting a read/write head (if necessary).

C. Activating the WRITE GATE line (OV to .4V).

D. Placing data to be written on the WRITE DATA line.

The timing characteristics required to initiate a write operation are shown in Figure 3-8. The timing requirement for FM encoded data to be written is shown in Figure 3-12. These timing requirements ensure that the selected read/write head is positioned and stabilized at the desired track prior to writing and to ensure flux change occurrence at the desired transfer rate. After the drive and head has been selected the WRITE GATE signal (P1-40) must go low (page 3, area B7). This makes U28-6 go high; U27-6 go low; and U31-10 go low disabling the step circuitry. Also, U28-6 going high make U31-3 (area B6) go low; and U29-12 go high to develop the + Write Enable signal. The + Write Enable signal on page 2 (area B7) enables write flip flop U12 and the erase circuitry. WRITE DATA clocks the write flip flop, U12, which changes states with each data bit to be written. On the flip flop's output through open-collector U1 pin 2 and 6, any low level signal will pass through its respective transistor, forward bias its associated diode (CR5 and CR9), and pass current through the coil. On the next write data bit the flip flop will toggle, causing current to flow in the opposite direction; thereby storing a high data bit as a flux reversal on the diskette.

3.6.7 Read Operation

Data can be read from the disk drive by:

A. Selecting the drive.

B. Selecting a read/write head (if necessary).

C. WRITE GATE being inactive.

Prior to a read operation, a time delay must be applied to stabilize the position of the read/write heads. The timing required for read operations is shown in Figure 3-6.

A read/write head senses flux changes on the diskette and generates a sine wave with the peaks occurring at the time of the flux changes. Diskette Data from either head is routed through diodes CR6, CR8, CR3 and CR4 (page 2, area D5) and on to amplifier U6 for flux reversal detection. The filter network consisting of capacitors C11,12,13,14; resistors R14,15,16,17; and inductors L3,4,5,6 will filter out erroneous noise and shape the data read for zero crossover detection. Pins 7 and 8 of differentiator U5 have a zero crossing that corresponds to each peak of the read signal. These outputs are AC coupled through C7 and C8 to crossover detector U4 (area D2) which generates a low-to-high or a high-to-low digital transition for each zero crossing detected. Q1 and Q2 convert the signal to a +5V and ground level signal. One-shot U17 and flip flop U12 (area C3) are used to eliminate any false crossovers and U10, R48, and C28 will generate one pulse for each transition detected; in essense, a frequency doubler since each transition represents one data bit. The output of U10-8 (area C2) is sent to one shot U11-10 (area B4) where a 200ns READ DATA pulse is generated. This signal exits the drive on connector P1-46 (page 3, area C1).

The Model 40 Series can be used as either a single density or double density unit. If a double density recording (MFM encoding) scheme is used, then the WRITE DATA should be precompensated to minimize the peak shift effect. The controller should determine the amount of compensation from the data pattern. Refer to paragraph 3.7 for a discussion on data encoding and recovery.

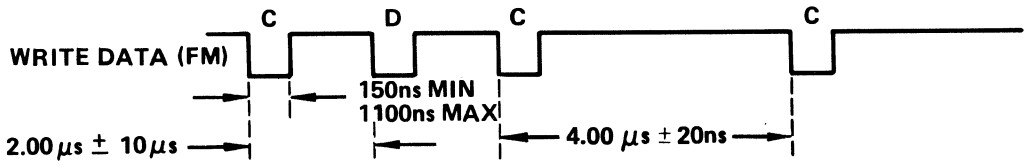


Figure 3-12: Write Data Timing (FM Encoding)

The MPI Model 40 Series read/write heads have a tunnel erase element for erasing between two adjacent tracks during writing. Figure 3-8 shows Erase "Turn On" and "Turn Off" time with respect to the WRITE GATE input line. Stepping is inhibited while erase is on.

3.6.8 General Control Timing

Timing requirements for the necessary sequence of events for control and data are shown in Figure 3-5. These timing restrictions are necessary for proper operation.

3.7 DATA ENCODING AND RECOVERY

This section provides applications information relevant to the recording and recovery of data with the Model 40 Series Disk Drives. The most common methods for encoding data are described in the following paragraphs.

3.7.1 Data Encoding

The Model 40 Series can be used as either single density or double density units. For single density, the FM encoding scheme is adequate while in double density drives, MFM encoding scheme is recommended. Due to the higher efficiency of MFM encoding, the bit cell period is one half of FM code and thus double density recording can be achieved. See Figure 3-13 for a comparison of FM and MFM encoding schemes.

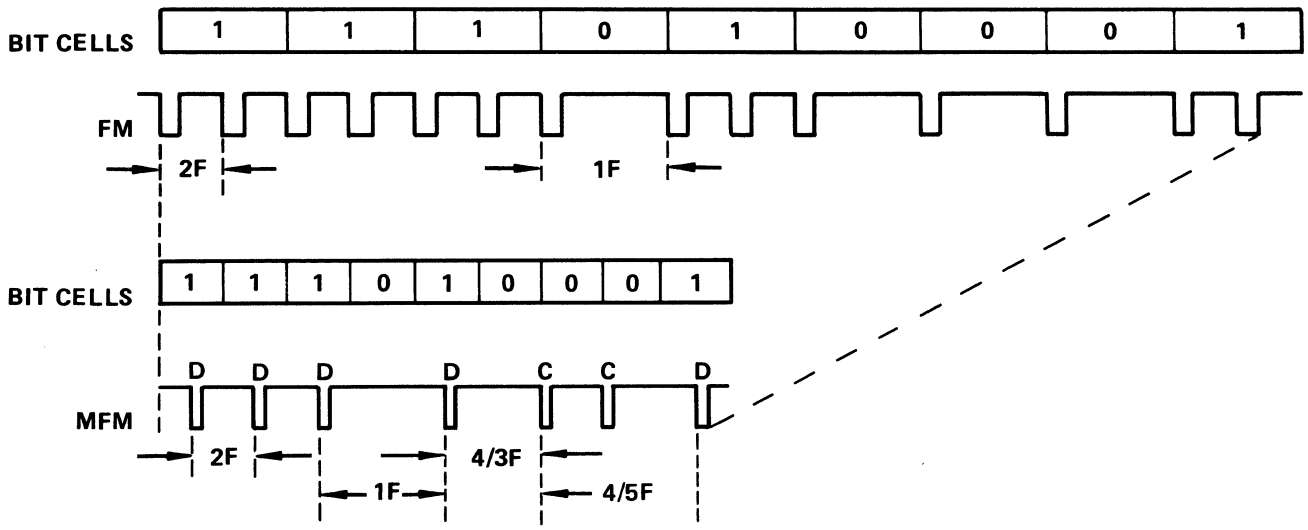


Figure 3-13: FM and MFM Code Comparisons

NOTE

Timing diagrams, figures 3-14 and 3-15, show data as "Low True".

3.7.1.1 FM Encoding

FM (frequency modulation) encoding has the following rules:

A. A data bit, if it is a "1", occurs at the center of the bit cell.

B. A clock bit occurs at the start of the bit cell.

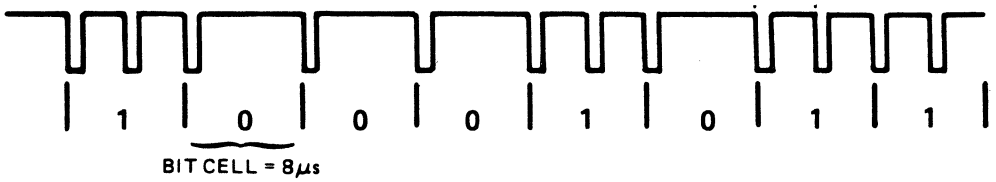


Figure 3-14: FM Encoding

3.7.1.2 MFM Encoding

MFM (modified FM) encoding has the following rules:

A. A data bit, if it is a "1", occurs at the center of the bit cell.

B. A clock bit occurs at the start of the bit cell, but only if no data bit occurred in the previous bit cell and no data bit will occur in the current bit cell.

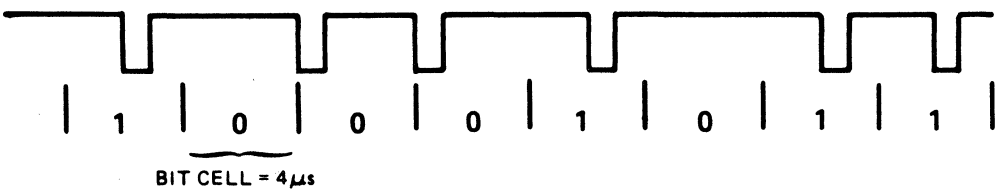


Figure 3-15: MFM Encoding

3.7.2 Data Recovery

Data recovery refers to the retrieving of data from the flexible diskette. The following paragraphs describe the problems associated with data recovery and methods to ensure data reliability.

3.7.2.1 Bit Shift

Bit shift refers to the displacement of a bit, as detected by the drive, from its nominal position. The causes of bit shift are manifold -- R/W head resolution, media resolution, diskette speed variation, signal-to-noise ratio of read head output.

3.7.2.2 Write Precompensation

Certain data patterns cause more bit shift than other patterns. This bit shift is predictable and can thus be partially compensated for. For example, if it is known that a bit will be shifted by 500 ns when it is read back, then the bit can be deliberately written 200 ns early. This would give a bit shift of about 350 ns when it is read back. This method of reducing bit shift is called write precompensation.

Bit shift is greater on the inner tracks of the diskette than on the outer tracks, making write precompensation necessary only on the inner tracks. Write precomp of 250 to 300 ns should be used on tracks 44 through 77. If due to controller limitations, write precomp must be used on all tracks, then 125 to 150 ns should be used.

3.7.2.3 Data Separation

Data separation refers to the separating of the composite data coming from the drive into separate clock and separate data bits.

Normally in a read operation raw read data or encoded data is provided to the controller and data separation or decoding is done by the controller. But as an option for FM code, separated data and clock are provided along with the raw read data. For MFM encoded data, decoding should be done by the controller using a suitable phase lock loop circuit or else maximum read channel margin (and hence the specified soft error rate) cannot be achieved. See Figure 3-9 for FM encoded data separation. The optional data separator properly separates data and clock bits through the soft-sectored IBM standard format and address mark areas.

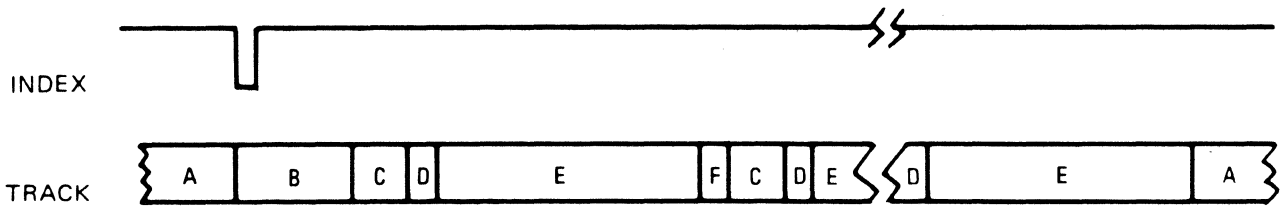
In MFM recording, data bits and clock bits are subject to the same amount of bit shift. A PLL separator with a 50% data window and a 50% clock window should be used.

3.7.2.4 Track Format

When determining the track format to be used, the following timing restraints should be considered (see Figure 3-16).

A. Postamble: The postamble period must be at least 3 ms to allow for a spindle speed variation of ±1 1/2%.

B. Data Gap: The data gap period must be at least 1 ms to allow for tunnel erase turn off time.



A – Postamble
B – Preamble
C – ID Record
D – ID Gap
E – Data Record
F – Data Gap

Figure 3-16: Typical Track Format

SECTION 4

MAINTENANCE

4.1 INTRODUCTION

This section contains preventive maintenance procedures, component removal/replacement procedures, and adjustment and measurement procedures. The material is referenced to drawings located throughout the text, a spare parts list located in Appendix A, and drawings and schematics located in Appendix B. Adjustment procedures will be required if parts are changed due to malfunction and measurements should be made periodically to ensure data quality or if malfunctions are suspected. It is recommended that a master alignment diskette be kept and that each alignment be verified to the master.

Table 4-1: Section Index

Topic	Paragraph
General Information	4.2
Preventive Maintenance	4.3
Recommended Tools and Test Equipment	4.4
Removal/Replacement Procedures	4.5
Adjustment Procedures	4.6
Measurement Procedures	4.7

4.2 GENERAL INFORMATION

The following statements are applicable to all facets of drive maintenance:

A. Do not remove any components or the printed circuit boards or connect or disconnect any plugs while power is applied to the drive.

B. Component-location instructions are referenced as viewed from the front of the drive.

C. Female connectors that carry signals internal to the drive slip over pins of the male connectors. Most of the connectors are keyed so that they cannot be plugged into the wrong receptacle. However, they can be inserted upside down. For positioning accuracy one side of the female connectors is slotted with so-called "windows" over the pins. Some installation instructions are given to install the connectors with the window side facing a certain direction, i.e., toward the chassis, away from the chassis, etc.

D. Do not use magnetic tools within the drive.

E. Instructions are given to "remove screws or replace screws"; it is understood that flat washers, lock washers, and shims (where required) are also to be removed and, more importantly, replaced. It is important to always replace the exact quantity of washers and shims that were removed and in the same order.

4.3 PREVENTIVE MAINTENANCE

The only recommended preventive maintenance to ensure optimum performance of the disk drive is periodic cleaning of the read/write head(s) and inspection of the head load pad.

4.3.1 Read/Write Head(s) and Load Pad Inspection

Inspect the load pad (or top head) for excessive oxide, using a dental mirror.

CAUTION

Do not move the upper head arm any further than is allowed by the door in its open position.

To clean the head(s) use a lint-free cloth or a cotton swab moistened with either methyl alcohol or 91% Isopropyl alcohol. Wipe the head(s) carefully to remove all accumulated oxide and dirt. Dry the head(s) using a lint-free cloth. If cleaning the head(s) does not improve operation, refer to the troubleshooting section. If head(s) are damaged or worn, refer to the head/carriage replacement procedure (paragraph 4.5.10). If head load pad is dirty or worn, refer to head load pad replacement procedure (paragraph 4.5.12).

4.4 RECOMMENDED TOOLS AND TEST EQUIPMENT

The following list of tools and test equipment are recommended for the removal/replacement procedures and the adjustment and measurement procedures in this section.

4.4.1 Removal/Replacement

A. Wire cutters

B. Needlenose pliers with serrated jaws

C. Phillips head screwdriver, No. 0 and No. 1

D. Phillips head torque screwdriver, No. 0 set to 20 inch-ounces

E. Phillips head torque screwdriver, No. 1 set to 30 inch-ounces

F. Allen driver; #0, #2, #4, #6

G. Dental mirror

H. Nut driver; #2

I. Bent nose tweezers

J. Slot head screwdriver

4.4.2 Adjustment and Measurement

A. Oscilloscope, dual trace, with channel "add" and external sync capability

B. Read/write (scratch) diskette

C. CE alignment diskette; MPI P/N 79801-428

D. Phillips head screwdrivers, No. 0 and No. 1

E. Phillips head torque screwdriver, No. 0 set to 2.0 inch-ounces

4.5 REMOVAL/REPLACEMENT PROCEDURES

The following material gives sequential instructions for removing and replacing major components of the disk drive. Table 4-2 lists the removal/replacement procedures contained in this section. Figures 4-1 and 4-2 are top and bottom views of the disk drive that identify the components referenced in the replacement instructions given. The appropriate paragraph should be referenced and read in its entirety before performing any of these procedures.

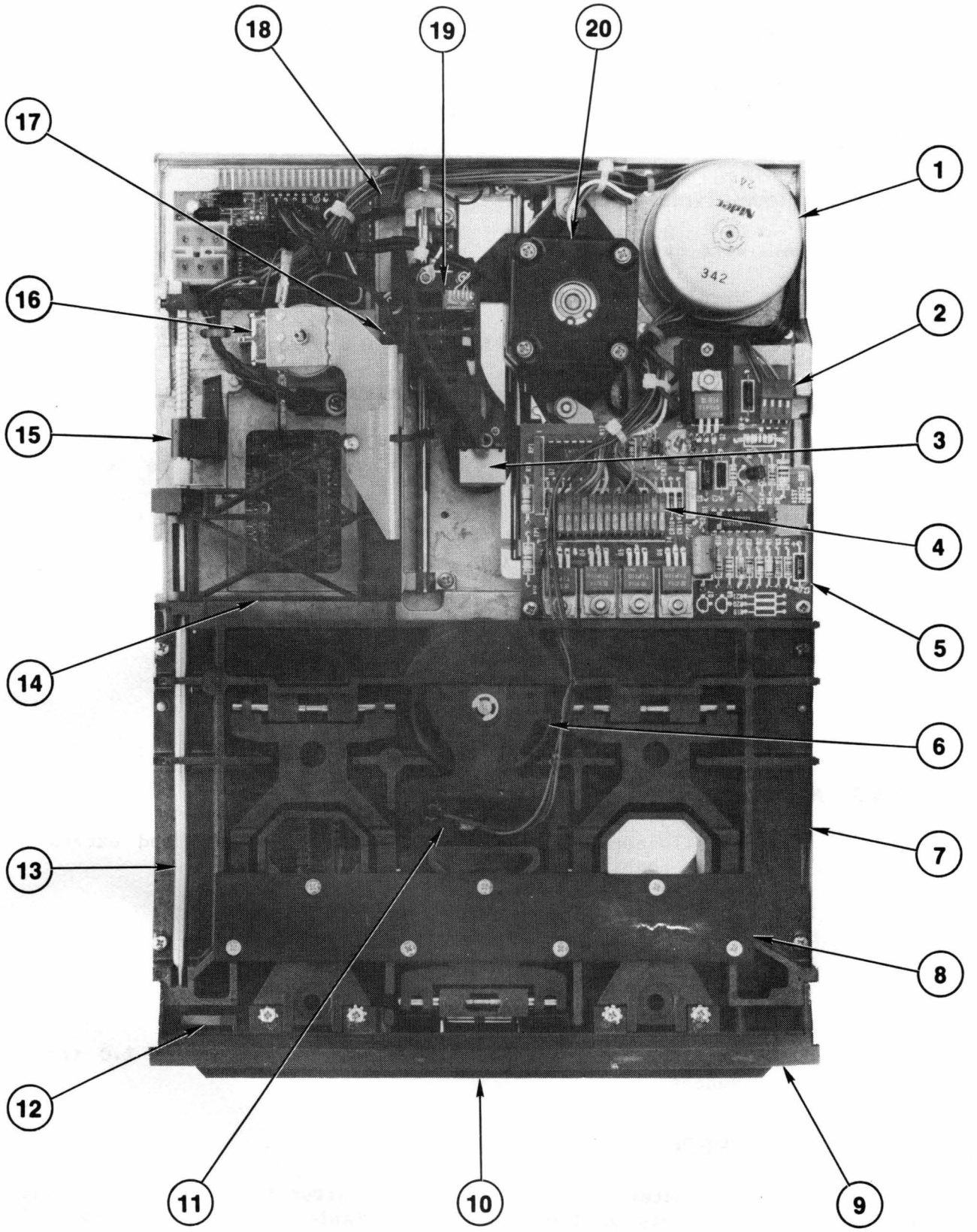


Figure 4-1: Top View of Drive

Parts Identification for Figure 4-1

1. Spindle Drive Motor
2. Spindle Speed PCBA Connector P1
3. Head Load Pad Area
   (Upper Read/Write Head Shown)
4. Spindle Speed PCBA Connector P2
5. Spindle Speed PCBA
6. Cone Assembly
7. Frame
8. Tie Strip
9. Bezel
10. Door
11. Index LEDs
12. Ejector Shaft Plastic Fork
13. Ejector Shaft
14. Pressure Pad Arm
15. Ejector Block
16. Head Load Solenoid
17. Track 43 sensor
18. Track 00 Sensor
19. Head/Carriage Assembly
20. Stepper Motor

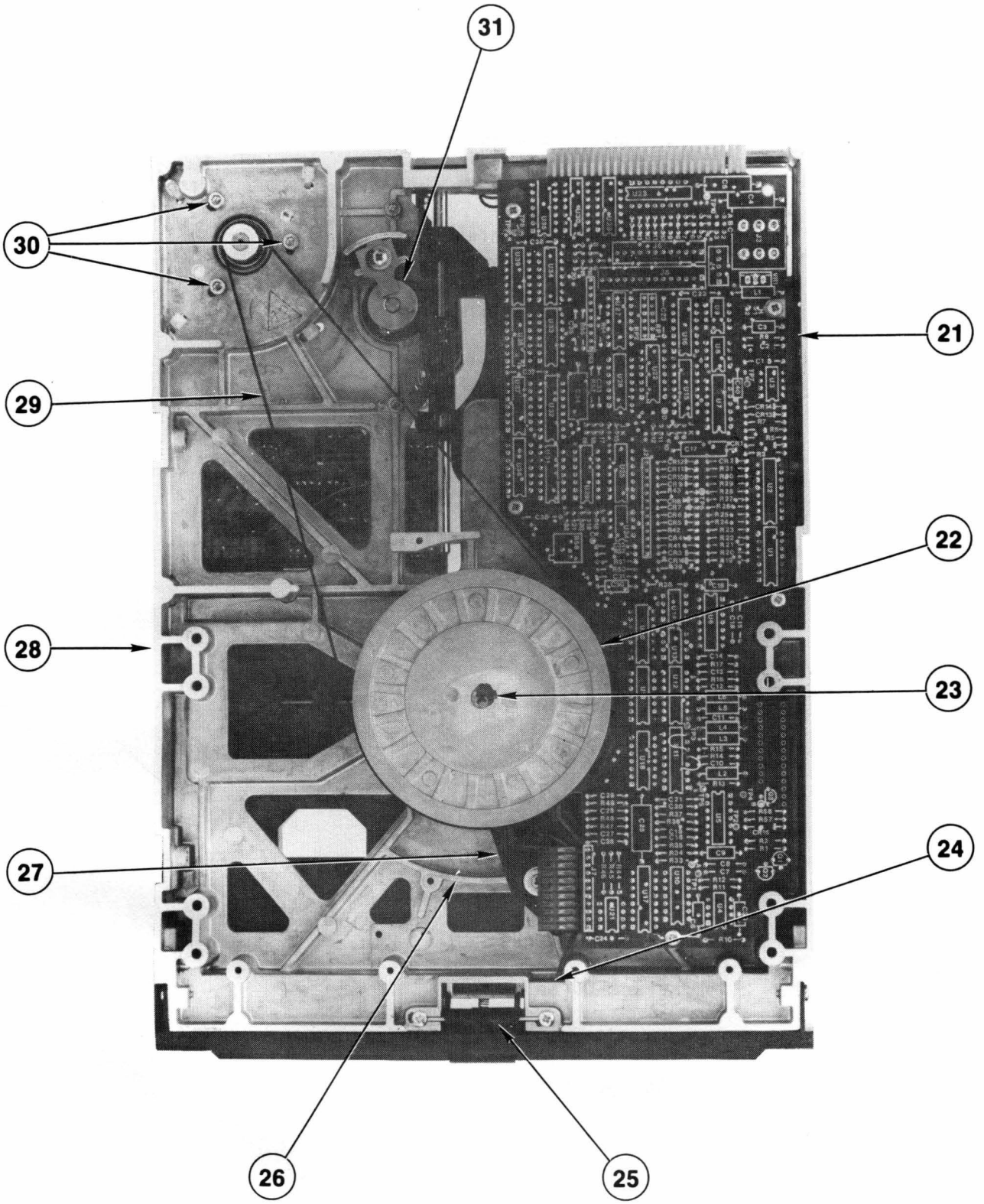


Figure 4-2: Bottom View of Drive

Parts Identification for Figure 4-2

21. Control Electronics PCBA
22. Spindle Pulley
23. Spindle Pulley Mounting Screw
24. Activity LED Connector (Location Shown)
25. Door Latch Mechanism
26. Index Sensor Assembly Alignment Rail
27. Index Sensor Assembly
28. Chassis
29. Drive Belt
30. Spindle Motor Mounting Screws
31. Stepper/Band Pulley

Table 4-2: Removal/Replacement Procedures

Procedure	Paragraph
Printed Circuit Board Assemblies (PCBA)	4.5.1
Front Panel Bezel and Activity LED	4.5.2
Cone Assembly	4.5.3
Clutch Arm Assembly	4.5.4
Head Load Solenoid	4.5.5
Track 00 And Track 43 Sensors	4.5.6
Spindle Drive Motor	4.5.7
Stepper Motor	4.5.8
Stepper Band	4.5.9
Head/Carriage Assembly	4.5.10
Ejector Assembly	4.5.11
Head Load Pad Assembly	4.5.12
Hub, Bearings, and Spindle Pulley	4.5.13
Door Latch Assembly	4.5.14
Index Sensors	4.5.15
Door Lock Mechanism	4.5.16

4.5.1 Printed Circuit Board Assemblies (PCBA)

There are two printed circuit board assemblies in the Model 40 Series. The Control Electronics PCBA is located under the drive, and the Spindle Speed Control Electronics PCBA is located on top toward the rear of the drive. To remove the printed circuit boards (PCBAs) proceed as follows:

4.5.1.1 Control Electronics PCBA

A. From the top side of the drive remove the I/O connector and DC power connector.

B. Turn the drive over and remove the five PCBA screws (refer to figure 4-2).

C. Remove connector P7 (refer to figure 4-3). Grip the connector not the cables when removing.

D. Remove connectors P4, P5, and P6.

E. Lift the PCBA slightly off the drive and disconnect head connector(s) from J2.

F. Remove the PCBA from drive.

To replace the Control Electronics PCBA perform the preceding steps in the reverse order.

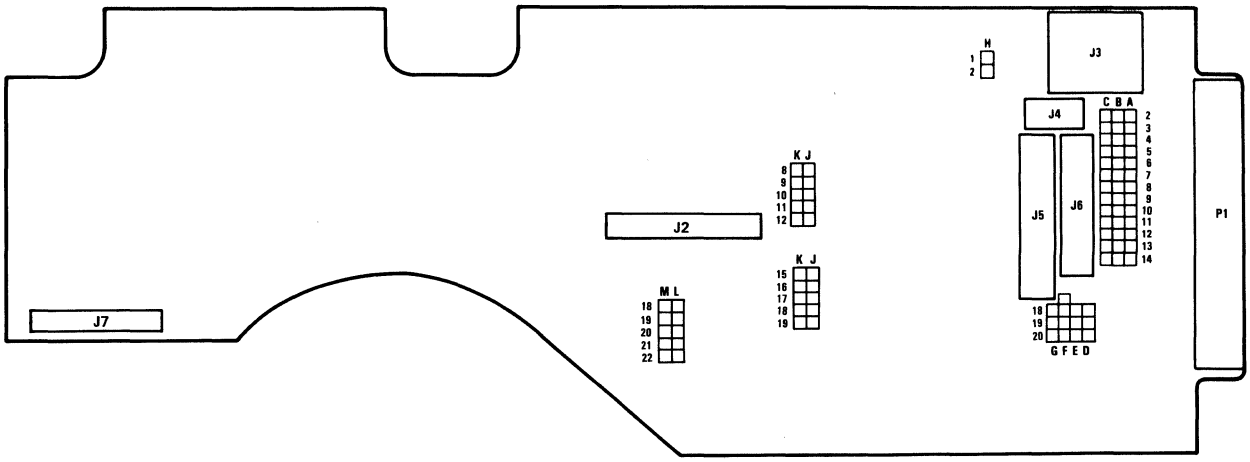


Figure 4-3: Control Electronics PCBA Connector Locations

4.5.1.2 Spindle Speed Control PCBA

A. From the top of the drive, remove connector P1 and P2 (refer to figure 4-1).

B. Remove the three PCBA screws.

C. Remove PCBA from drive.

To replace the Spindle Control Electronics PCBA perform the preceding steps in the reverse order.

4.5.2 Front Panel Bezel and Activity LED

To replace the activity indicator it is necessary to remove the bezel (refer to figure 4-4). To remove the bezel proceed as follows. Figure 4-5 shows the activity indicator mounting hardware:

A. Remove the female connector from the activity LED on the bottom side of drive (refer to figure 4-2).

B. Loosen the four screws holding the bezel to the drive chassis (refer to figure 4-4).

C. Open door to free bezel (if closed).

D. Pull bezel forward and remove from drive.

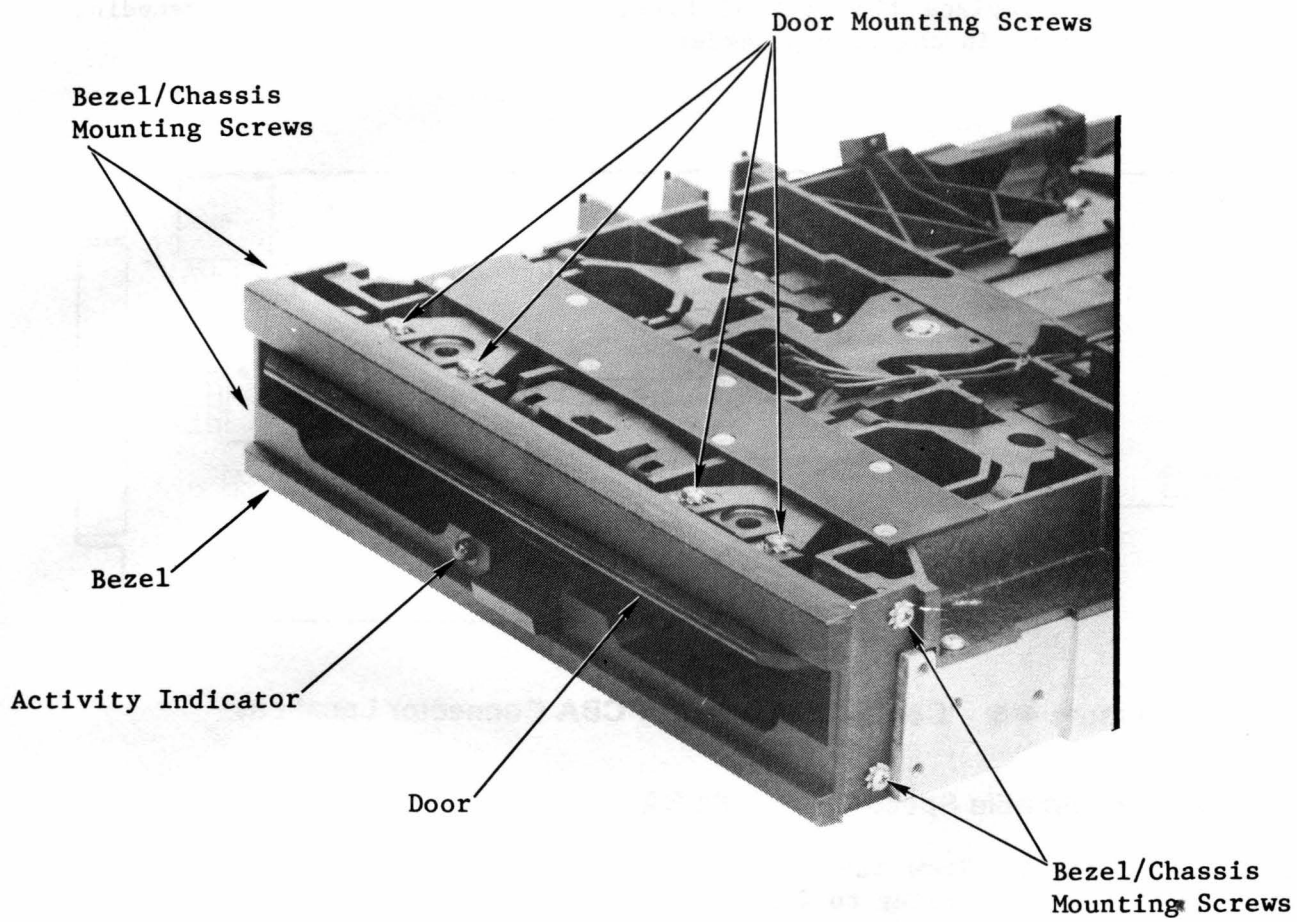


Figure 4-4: Front View of Drive

4.5.2.1 Activity LED Removal

To replace the activity LED proceed as follows:

A. Remove bezel (see paragraph 4.5.2).

B. Loosen activity indicator ring around activity indicator clip and pry off.

C. From the front of the bezel, press LED out of the holder. This removes the LED.

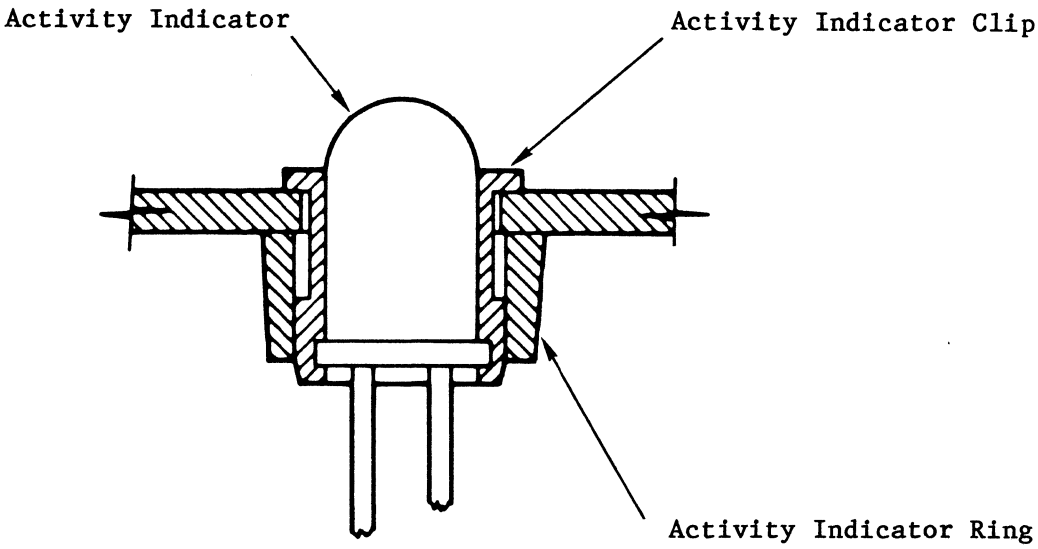


Figure 4-5: Activity Indicator Assembly

4.5.2.2 Activity LED Installation

To install the activity LED proceed as follows:

A. Perform the steps in paragraph 4.5.2.1.

B. Press LED into clip in bezel from rear of bezel until it snaps in.

C. Hold LED clip with fingers and fit ring over rear part of clip. Press ring until it is flush against bezel.

D. Fit female connector over LED leads with black wire connected to longest LED lead.

E. Install bezel to drive chassis and frame by performing the steps in paragraph 4.5.2 in the reverse order.

4.5.3 Cone Assembly

The cone assembly fits within the drive spindle assembly and is attached to the clutch arm. To remove this assembly proceed as follows:

A. Remove the clutch arm (see paragraph 4.5.4).

B. Remove the snap ring and shims from the top of the clutch arm assembly (refer to figure 4-6).

C. Cone can now be removed from clutch arm.

To replace the cone assembly perform the preceding steps in the reverse order.

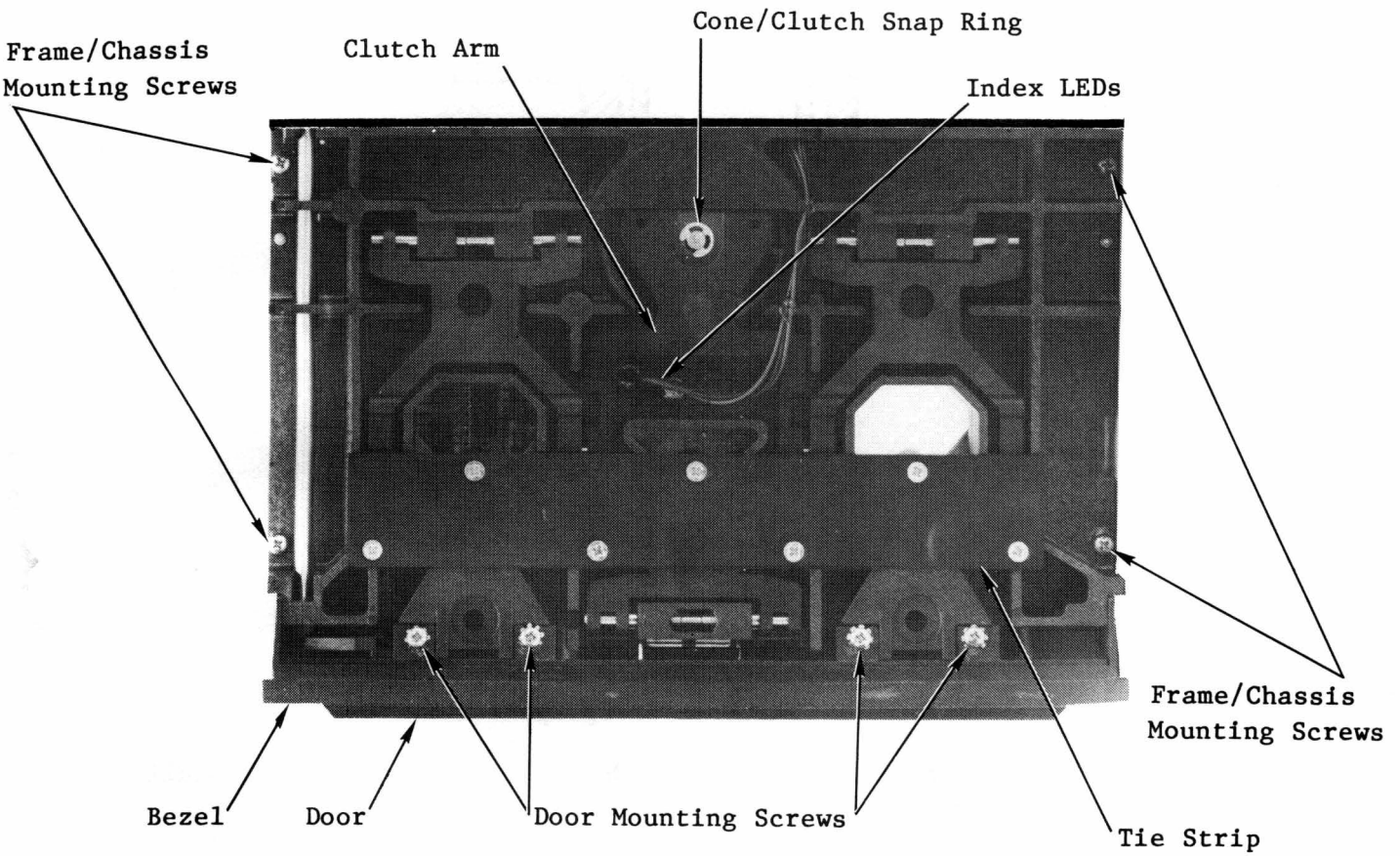


Figure 4-6: Frame Assembly

4.5.4 Clutch Arm Assembly

The clutch arm assembly lifts the cone from the spindle when the door is opened. To remove this assembly proceed as follows:

A. Remove the Spindle Speed PCBA (see paragraph 4.5.1.2).

B. Remove bezel assembly (see paragraph 4.5.2).

C. On the top of the drive remove the seven screws from the tie strip (refer to figure 4-6).

D. Remove the four door mounting screws.

E. Cut the shrink tubing away and unsolder the wires from the index LEDs. Be sure to label which wires go to which leads on each LED.

F. Remove the four screws from the sides of the frame which secure the frame to the chassis.

G. Remove the ejector shaft support block screw (refer to figure 4-12).

H. Remove frame from chassis.

I. With a flat blade screw driver work the clutch arm pivot pin from the frame (refer to figure 4-7). Locate the notch in

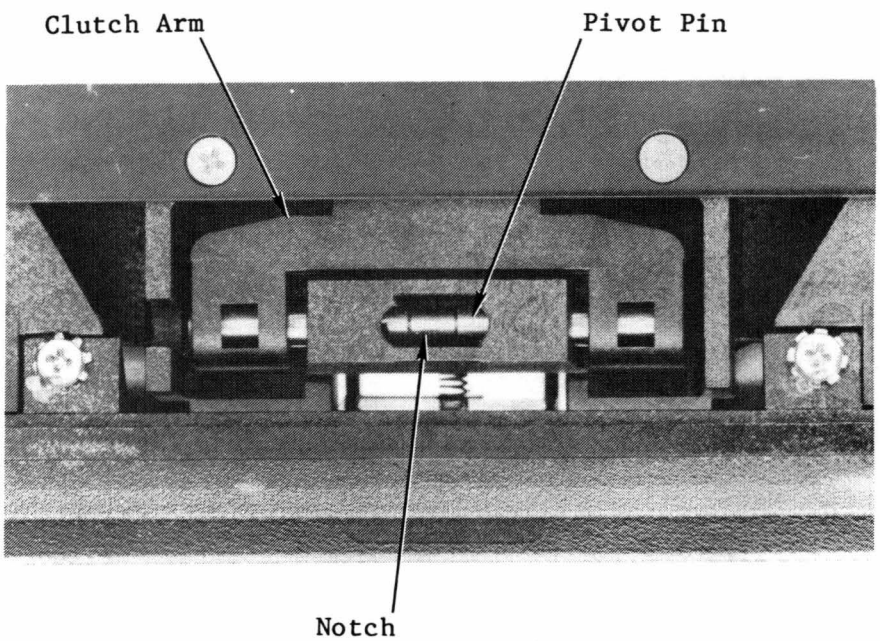


Figure 4-7: Clutch Arm Pivot Pin

the pin and force it toward the left (as viewed from front of drive), first from the top of the frame and then from the bottom.

J. The clutch arm assembly can now be removed from the frame. Be careful not to lose the spring mounted under the clutch arm.

K. To replace the clutch arm perform the preceeding steps in reverse order.

4.5.5 Head Load Solenoid

To remove the solenoid, proceed as follows (refer to figure 4-8):

A. Remove the Control Electronics PCBA (see paragraph 4.5.1.1).

B. Remove the wires from the two solenoid lugs.

C. Turn the drive on its side and remove the solenoid mounting screw from bottom of drive chassis.

D. Solenoid is now free.

CAUTION

Be careful not to lift solenoid load arm straight up so that it bends the upper arm assembly past its normal unloaded position.

E. Tilt solenoid up and slide the load arm out from under the upper arm assembly and out of the drive chassis.

To replace the solenoid perform the preceding steps in the reverse order; be sure that:

A. The top part of the load arm is beneath the top step of the upper arm (refer to figure 4-6).

B. Wires are not pinched between the bottom of the solenoid and the disk drive chassis.

C. Wires do not interfere with solenoid spring.

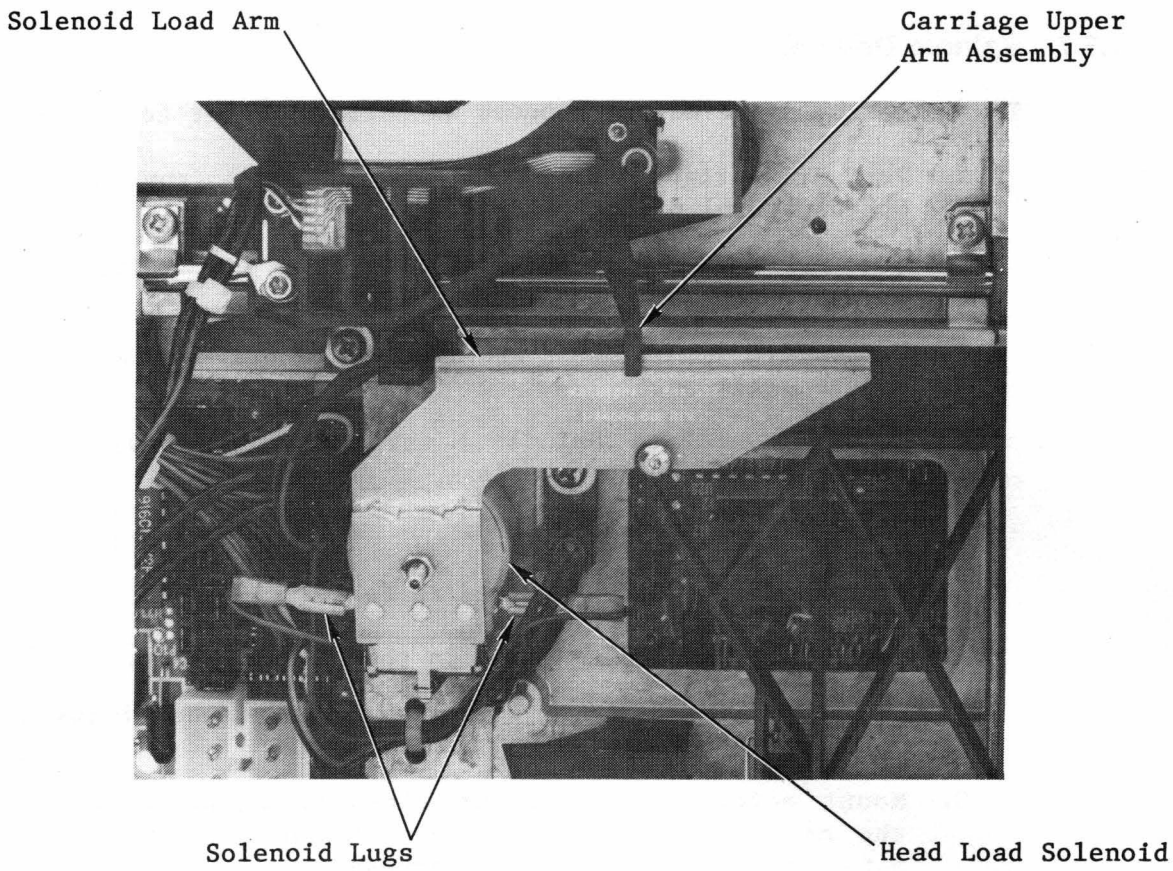


Figure 4-8: Head Load Solenoid

4.5.6 Track 00 And Track 43 Sensors

To remove the Track 00 or Track 43 sensor proceed as follows (refer to figure 4-1):

A. Remove the screw at top of chassis holding the sensor assembly to the drive chassis.

B. Cut the shrink tubing away on all four wires exposing the solder joints.

C. Proceding one at a time, unsolder a wire from the old sensor; slip a piece of shrink tubing over the wire; solder the wire to the same connector on the new sensor.

D. Install the screw which fastens the sensor to the drive.

E. Perform the Track 00 and Track 43 Sensor adjustment; refer to table 4-3.

4.5.7 Spindle Drive Motor

To remove the drive motor, proceed as follows (refer to figure 4-1):

A. Turn drive right side up and disconnect P2 from the Spindle Speed Control Electrionics PCBA.

B. Cut all necessary tie wraps to free the spindle motor harness.

C. Turn drive upside down and remove the drive belt (refer to figure 4-2).

D. Remove the three Spindle Motor mounting screws from the bottom of the drive chassis.

E. The drive motor is now free.

To replace the drive motor proceed as follows:

A. Perform the preceding steps in the reverse order.

B. Be sure that the wire harness is not pinched between the motor and the chassis.

C. Mount motor so that motor wires exit the motor toward the center of drive chassis. Connect P2 and tie wrap motor wires into drive wire harness.

D. Install drive belt.

4.5.8 Stepper Motor

To remove the stepper motor proceed as follows (refer to figure 4-1):

A. Remove the stepper band (see paragraph 4.5.9).

B. Cut tie wraps enclosing stepper motor wires in wire harness and unplug connector P4 (refer to figure 4-3).

C. From the bottom of drive remove the two hex screws securing the stepper motor to the chassis (refer to figure 4-10).

D. Remove stepper motor from drive chassis.

To replace the stepper motor, perform the preceding steps in the reverse order.

4.5.9 Stepper Band

To remove the stepper band proceed as follows:

A. Turn drive upside down and remove the spindle drive belt (refer to figure 4-2).

B. Remove the spring/carriage hex screw securing the spring side of the stepper band to the carriage (refer to figure 4-9).

C. Remove the nut and stud securing the non-spring side of the stepper band to the carriage (refer to figures 4-10). Do not remove the hex screw and nut which fasten the spring to the stepper band.

D. Remove the hex screw and clip that mounts the band to the pulley.

E. Band can now be lifted off stepper motor pulley.

To replace the band perform the following steps:

A. Consider the preceding steps in the reverse order.

B. On the band, slip the non-spring side through the slot in the band.

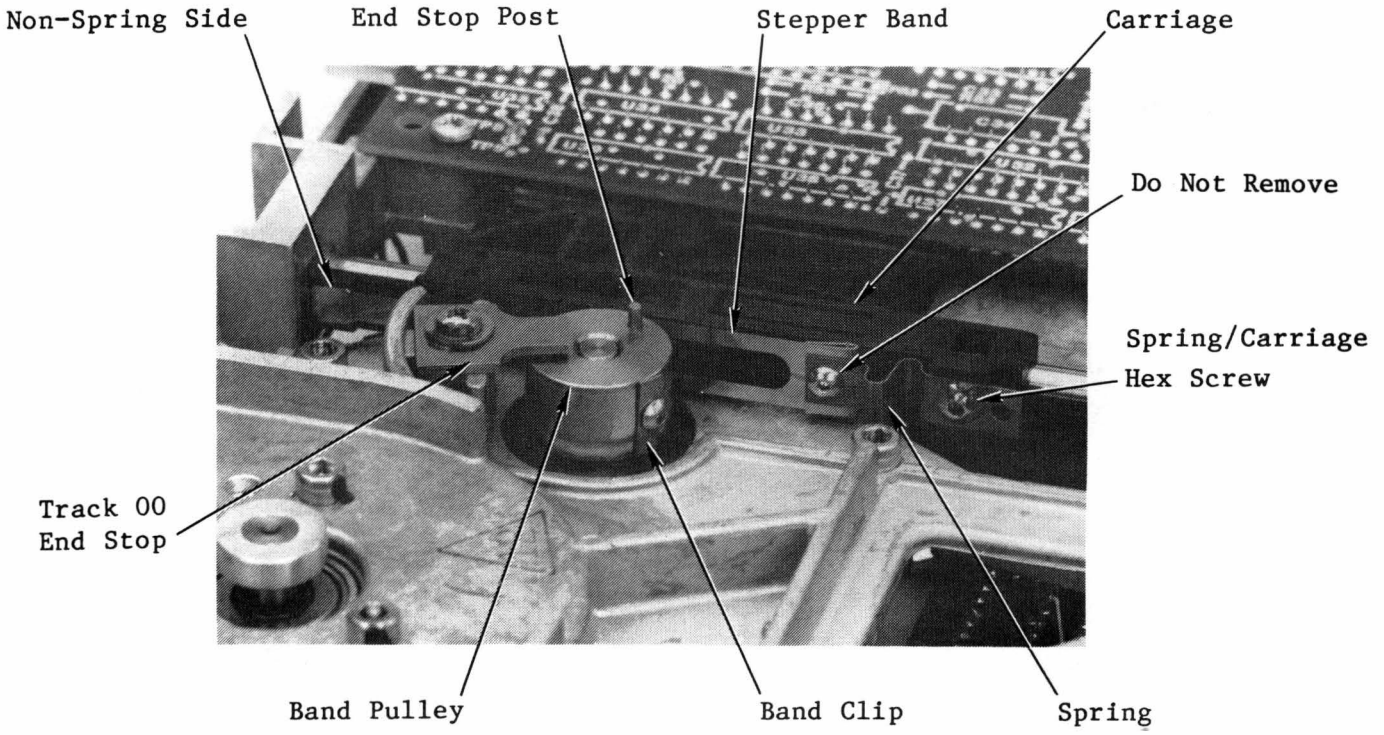


Figure 4-9: Stepper Band, Side View

C. Wrap the band around the pulley and install the hex screw and clip, mounting band to pulley, but do not tighten.

NOTE

The stepper band is installed so that the band spring is toward the front of the drive (refer to figure 4-9).

D. Install the stud and nut, mounting the non-spring side of the band to the head/carriage assembly.

E. Hold band firmly against head/carriage assembly; install hex screw to spring side of band.

F. Pull band tight against head/carriage assembly and tighten screw. Move carriage forward and backward; ensure that there is no band crinkle (metal on metal rubbing).

G. Hex screws (band/pulley and band/carriage) should be torqued to 3 in. lbs. and stud/nut torqued to 2.25 in. lbs.

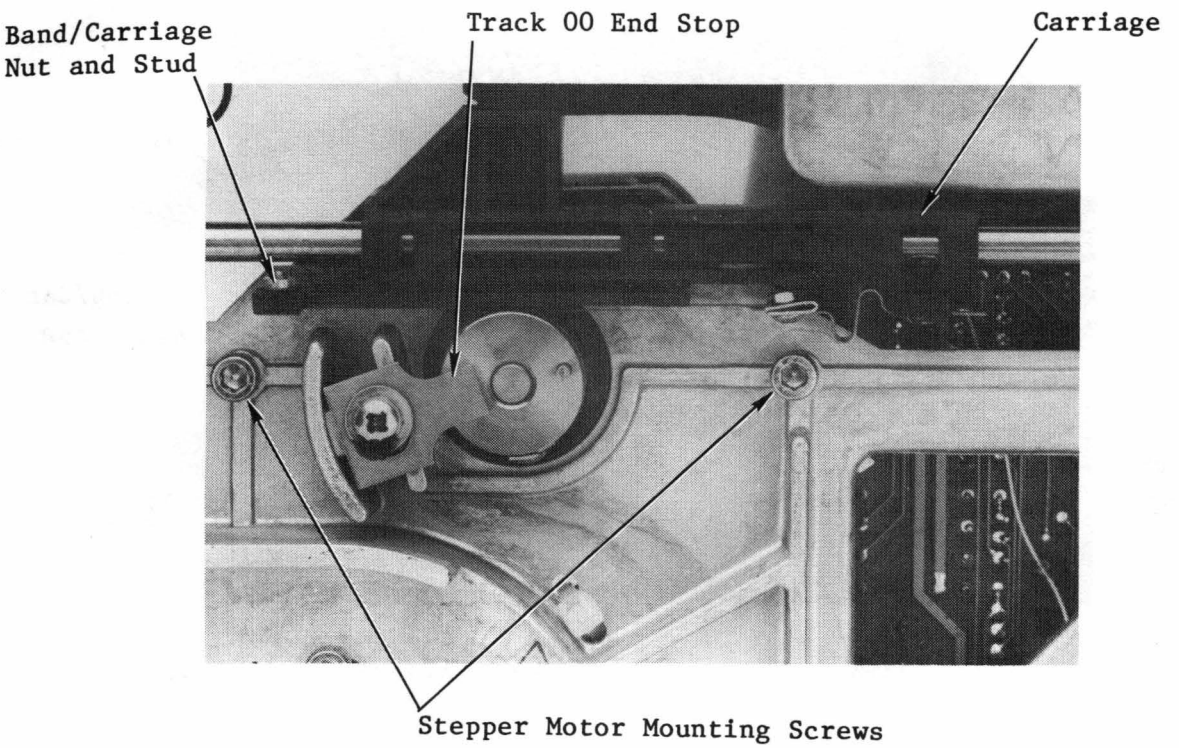


Figure 4-10: Stepper Band, Top View

4.5.10 Head/Carriage Assembly

To remove the head/carriage assembly proceed as follows (refer to figure 4-11):

A. Remove the Spindle Speed and Control Electronics PCBAs (see paragraph 4.5.1).

B. Remove the stepper motor (see paragraph 4.5.8).

C. Cut tie-wraps if necessary to release the head cable(s) from the drive harness.

D. Remove the four guide rod clamps.

E. Position the track sensor flag on the head/carriage assembly between the track 00 and 43 sensors.

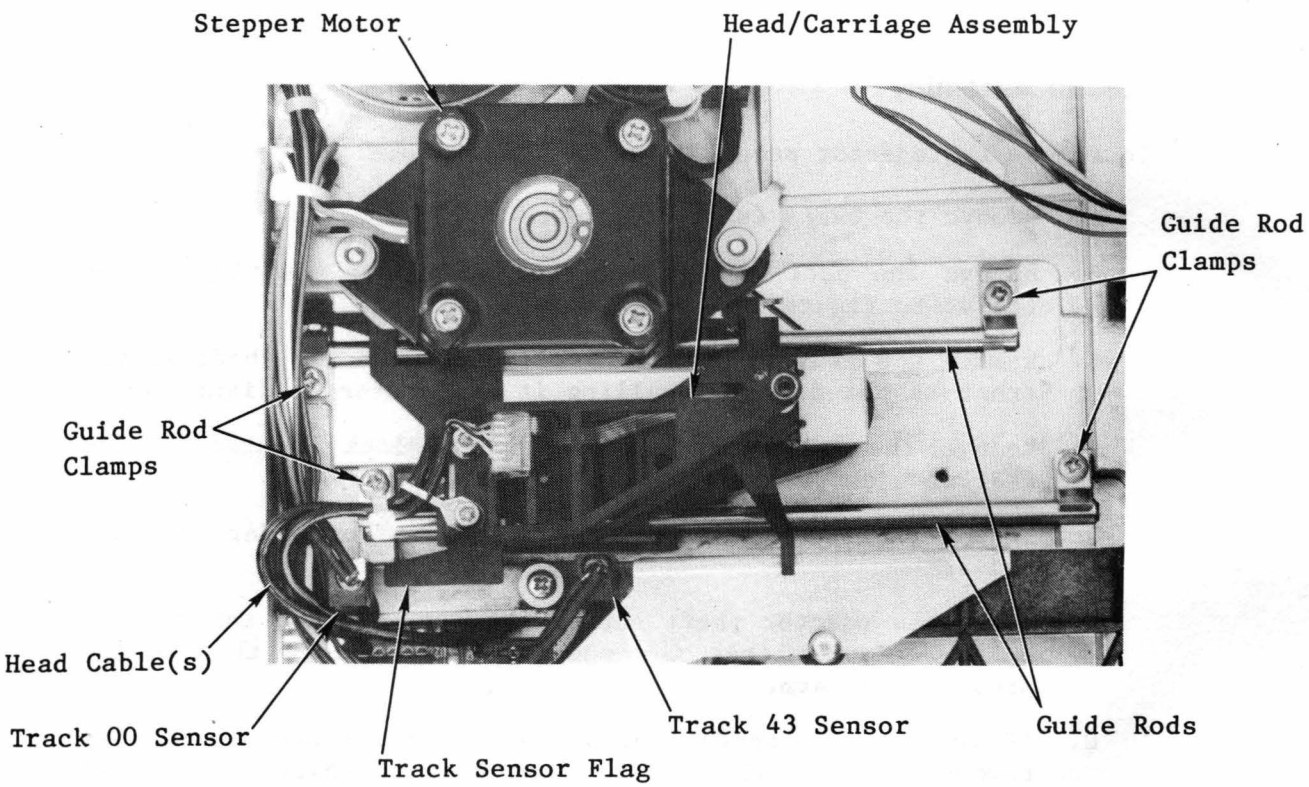


Figure 4-11: Head/Carriage Assembly

F. Lift head/carriage assembly and guide rods out of drive chassis.

NOTE

Be careful of banging and bending head/-carriage upper arm.

To replace the head/carriage assembly, perform the preceding steps in the reverse order and observe the following precautions:

A. Be sure that the guide rods are firmly seated in the drive chassis.

B. Route head cables from head/carriage assembly through chassis properly.

C. Be sure guide rod clamps are securely tightened.

D. Be sure carriage rides freely on guide rods after installation.

4.5.11 Ejector Assembly

To remove the ejector assembly proceed as follows:

A. Remove the bezel (see paragraph 4.5.2).

B. Remove the door by removing the four door mounting screws (refer to figure 4-4).

C. Remove the plastic fork mounted to the ejector shaft at the front of the drive by pulling it off (refer to figure 4-1).

D. Remove the screw and shaft support block located at the rear of ejector shaft (refer to figure 4-12).

E. Unhook pressure pad arm torsion spring from under pressure pad arm.

F. Slide the ejector shaft out of the frame toward the rear of drive. Notice that the ejector shaft slides through the pressure pad arm.

G. If the ejector spring and/or ejector block needs replacing remove the retaining ring at the rear of shaft, then slide the spring and ejector block off the shaft.

To replace the ejector assembly, perform the preceding steps in the reverse order then;

A. Perform the ejector tension/release adjustment; refer to table 4-3.

B. Perform the pressure pad arm adjustment; refer to table 4-3.

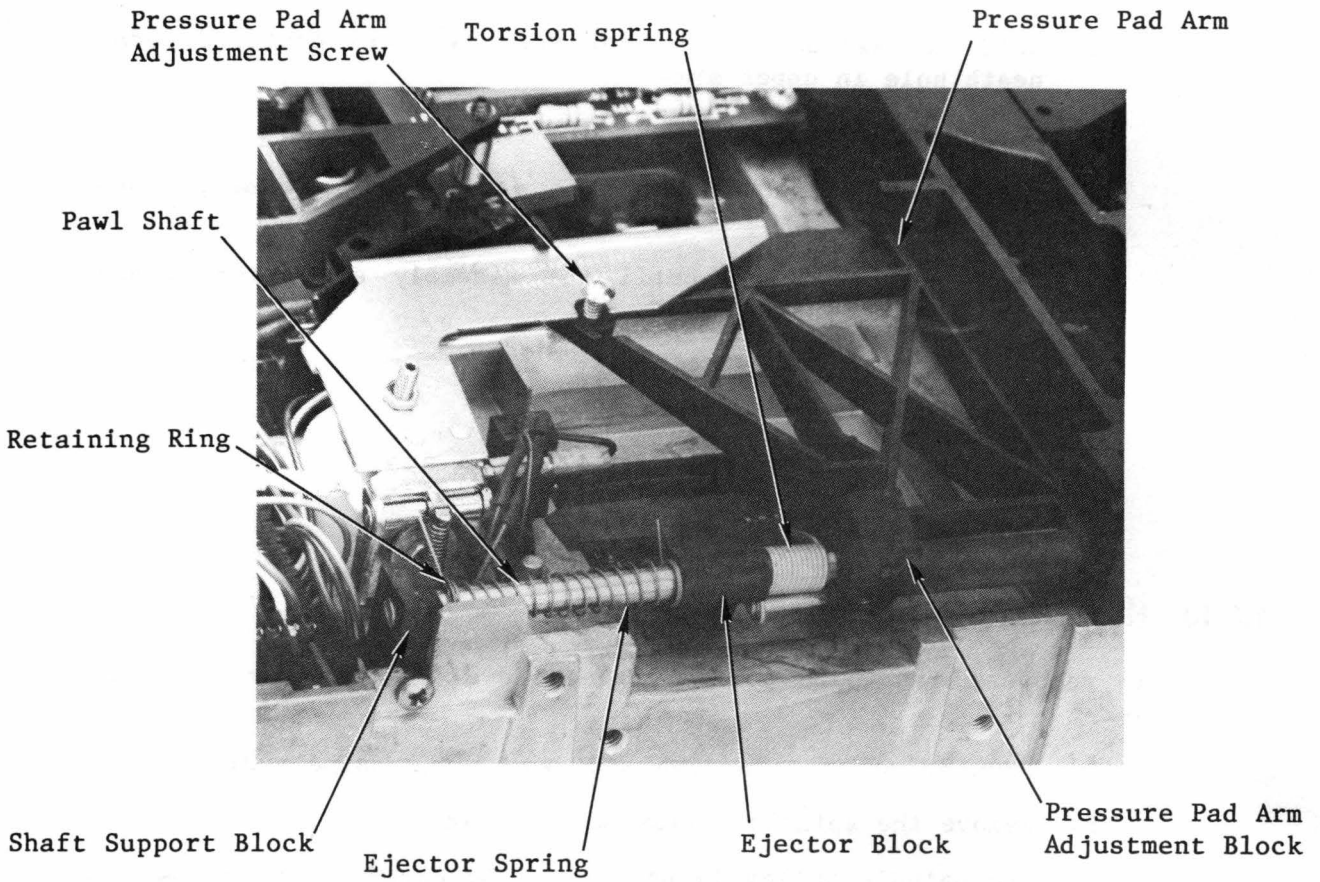


Figure 4-12: Ejector Assembly

4.5.12 Head Load Pad Assembly

To replace the head load pad assembly in Model 41 drives, proceed as follows (refer to figure 4-1):

A. Manually position head/carriage assembly all the way to the rear of the drive (Track 00); be sure to push carriage <u>not</u> the upper arm.

B. Open door.

C. Grip upper arm.

D. With bent nose tweezers, squeeze the plastic pieces of the Head Load Pad which protrude through the upper arm and press until it drops out of the upper arm.

To replace the pad assembly proceed as follows:

A. Hold pad assembly with bent nose tweezers centered underneath hole in upper arm.

B. Close door.

C. Press lightly on upper arm to engage pad assembly; remove tweezers.

D. Press on upper arm until pad assembly snaps into place.

CAUTION

Do not move the upper head arm any further than is allowed by the door in its open position.

4.5.13 Hub, Bearings and Spindle Pulley

To remove the spindle pulley proceed as follows (refer to figure 4-2):

A. Turn drive up side down and remove the spindle drive belt.

B. Remove the spindle pulley mounting screw.

C. The spindle pulley is now free. Be careful not to lose the wave washer located between the spindle pulley and bearing.

To remove the hub complete the preceding steps then proceed with the following:

A. Remove the clutch arm (see paragraph 4.5.4).

B. Hub can now be removed from the drive.

To replace the bearings, the unit must be returned to the factory.

4.5.14 Door Latch Assembly

To remove the door latch assembly proceed as follows:

A. Remove bezel (see paragraph 4.5.2).

B. On the bottom of the drive, remove the two screws which clamp the door latch rod to the chassis (refer to figure 4-13).

NOTE

Be careful not to lose the door latch spring and rod as they are not fastened to the door latch.

C. Remove door latch, spring, and rod from the drive.

To replace the door latch assembly perform the preceding steps in the reverse order and also;

A. Verify that door lock arm impedes latch movement when solenoid arm is actuated manually, and does not impede latch movement when solenoid arm is in the "at rest" position.

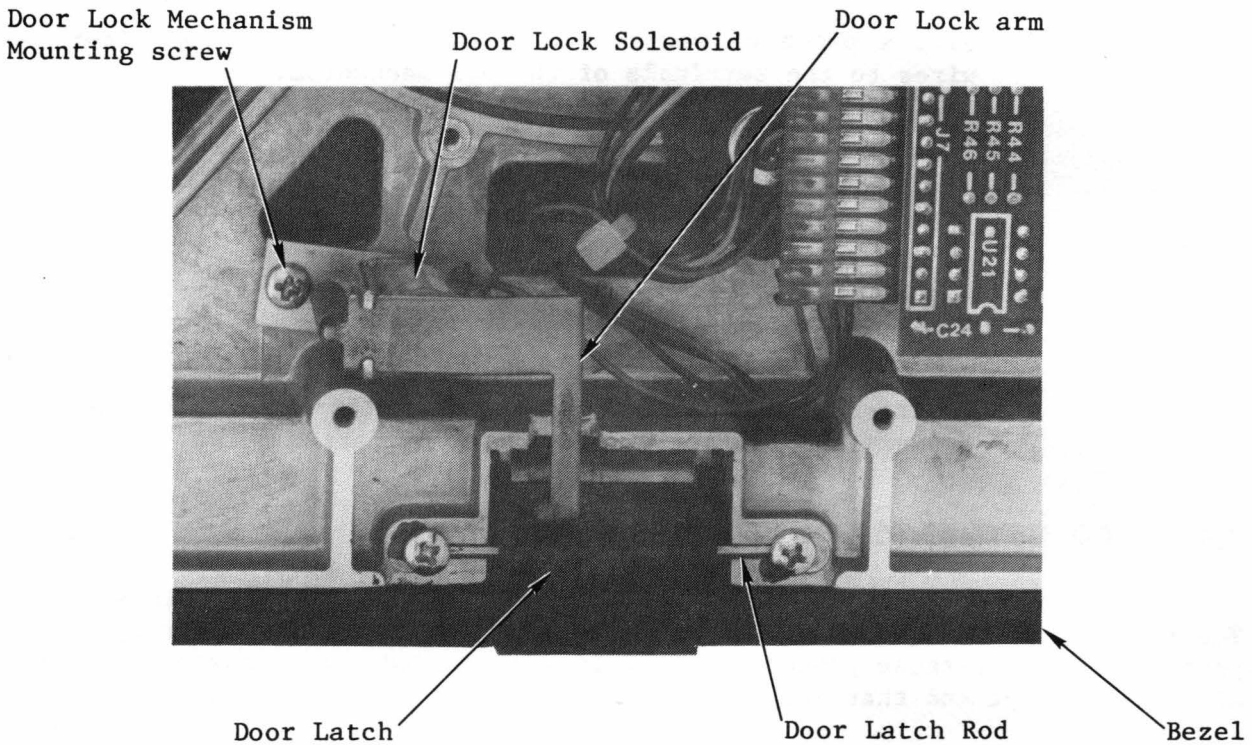


Figure 4-13: Door Lock and Latch Assemblies

4.5.15 Index Sensors

To remove the index sensors proceed as follows (refer to figure 4-2):

A. Turn the drive over and remove the connectors to the index sensors.

B. Remove the single index sensor assembly mounting screw.

C. The sensor assembly can now be replaced.

D. Perform the Index-to-Data Alignment Adjustment; refer to table 4-3.

4.5.16 Door Lock Solenoid

To remove and replace the door lock mechanism proceed as follows.

A. Turn the drive over and remove the single door lock mounting screw (see figure 4-13).

B. Cut door lock wires as close to the solenoid as possible.

C. Cut back the insulation and tin both wires.

D. Slip a piece of shrink tubing over each wire and solder the wires to the terminals of the new mechanism.

CAUTION

Be careful not to over heat the terminals as damage could result to the solenoid wires attached to the terminals.

E. Position the door lock arm between the door latch and the chassis and replace the door lock mechanism screw.

4.6 ADJUSTMENTS PROCEDURES

Table 4-3 lists the adjustment procedures contained in this section. The appropriate paragraph should be referred and read in its entirety before performing any of these procedures. It is recommended that a master alignment diskette be kept and that each alignment be verified to the master.

Table 4-3: Adjustment Procedures

Procedure	Paragraph
Radial-Track	4.6.1
Index-to-Data	4.6.2
Track 00 and 43 Sensors	4.6.3
Speed Control	4.6.4
Track 00 End Stop	4.6.5
Ejector Tension/Release	4.6.6
Pressure Pad Arm	4.6.7

4.6.1 Radial-Track Alignment

To perform the radial-track alignment proceed as follows:

A. Loosen the end-stop screw on the bottom of drive.

B. Apply power to the disk drive. Apply controls to the drive for recalibration to track 00.

C. Insert a CE alignment diskette (MPI Part No. 78901-428 double/single) and close the door.

D. Sync oscilloscope on leading edge of signal on TP 8 (output of U30-11, on Control Electronics schematics). Connect oscilloscope probes to TP4 and TP5 (inputs to U5-1, 14). Set the oscilloscope to 100mV/cm, ac coupled, channel A and B added, with B inverted, 20ms/division. Attach ground probe to minus side of C5.

E. Load head and apply 38 stepping pulses, with the DIRECTION line low. The carriage should now be located around track 38. The proper phase relationship of stepper motor phases should be: phase 4 and 1 = 0V, phase 2 and 3 = +24V.

F. With power on loosen the stepper motor mounting screws on bottom of drive and rotate the motor so that the "cat's eye" pattern appears on the scope and adjacent lobes are within 70% amplitude. However, ideal alignment is indicated when adjacent lobes have equal amplitude. Tighten mounting screws. Command a return to track 00 and then step back to track 38 to verify proper alignment. Command a seek to track 76 and then step back to track 38 to verify proper alignment.

G. Perform the Track 00 End Stop adjustment, paragraph 4.6.5.

4.6.2 Index-To-Data Alignment

To perform the index-to-data alignment perform the following steps in the order listed:

A. Verify the radial-track alignment (see paragraph 4.6.1) then move the head to track 73.

B. Set the oscilloscope to 200mV/cm; 50us/division.

C. The index sensor mounting screw is located at the bottom of the drive in the recessed area. Loosen the screw and slide the sensor such that the oscilloscope picture shows a data pattern starting 200 $\pm$100 microseconds from the start of the trace while keeping the sensor assembly pressed firmly against the sensor assembly alignment rail (refer to figure 4-2). MPI recommends that the alignment should be performed as close to 200usec as possible.

D. Using a 20 inch-ounce torque screwdriver, tighten the screws carefully so that no variations in the oscilloscope display occur.

4.6.3 Track 00 and 43 Sensor Alignment

To align the track 00 and 43 sensors perform the following steps in the order listed.

A. Apply power to the disk drive and select drive.

B. Verify the radial-track alignment (see paragraph 4.6.1).

C. Connect channel A probe to connector J5-12; set oscilloscope trigger to INTERNAL/AUTO.

D. Loosen the track 00 sensor mounting screw (refer to figure 4-1) and adjust the sensor for the conditions in E. and F. following.

E. When the carriage is positioned over track 00, the signal at J5-12 should be at 4.0 volts minimum.

F. Command a step-in to track 03. The signal at J5-12 should go to 0.5 volts maximum. Repeat several times.

G. Tighten the track 00 sensor mounting screw.

H. Connect channel A probe to connector J5-4.

I. Loosen the track 43 sensor mounting screw (refer to figure 4-1) and adjust the sensor for the conditions in J. and K. following.

J. When the carriage is positioned over track 43, the signal at J5-4 should be at 4.0 volts minimum.

K. Command a step-out to track 41. The signal at J5-4 should go to 0.5 volts maximum. Repeat several times.

L. Tighten the track 43 sensor mounting screw.

4.6.4 Speed Control Adjustment

To adjust the speed control perform the following steps in the order listed:

A. Apply power to the disk drive and select drive (send MOTOR ON if not a standard configuration).

B. Insert a diskette and close the door.

C. Turn disk drive on its side and observe the strobe effect of spindle pulley. If observed with 60 Hz lighting adjust R4 on Spindle Control PCBA for a stable strobe pattern. Note that a small amount of strobe "creep" is permissible. If operating in a 50 Hz environment, place probe on TP 8 on Control Electronics PCBA and adjust R4 for a 167ms. period between Index pulses.

4.6.5 Track 00 End Stop Alignment

To adjust the track 00 end stop perform the following steps in the order listed:

A. Verify the radial-track alignment (see paragraph 4.6.1).

B. Verify the track 00 sensor alignment (see paragraph 4.6.3).

C. Apply power to the disk drive and select drive.

D. Command a seek to track 00.

E. Adjust the end stop tab, located on the chassis at the rear of the drive, to approximately 0.010 inch from the end stop post which is mounted on the stepper pulley (refer to figure 4-9). Command a maximum track seek, then a return to track 00. Assure that the end stop post does not hit the end stop tab.

4.6.6 Ejector Tension/Release Adjustment

There are two parts to the ejector adjustment. One is to apply tension to the ejector block so it will latch when a diskette is installed; the second is to lift the ejector block so it will discharge when the door is opened. Adjustment assumes ejector has just been reassembled with no tensioning at all.

4.6.6.1 Ejector Tension

With the door open and the ejector discharged, slightly compress the spring and turn it two full revolutions counter-clockwise (as viewed from the front of drive). Hold the spring tension and let it decompress until the spring end is resting on the ejector block (refer to figure 4-12).

4.6.6.2 Ejector Release

With the door opened, ensure that the ejector release spring-end will rest on or slightly above the angled area of the ejector block when the ejector is loaded. Now close the door; spring-end should move beneath the ejector block. If it does not, bend the spring-end so that it does. Refer to figure 4-14 for the proper spring position.

4.6.7 Pressure Pad Arm Adjustment

On the pressure pad arm adjustment block, (refer to figure 4-12) the center screw is to secure the block to the ejector shaft and the upper set screw controls the attitude of the pressure pad arm. To adjust the pressure pad arm proceed as follows:

A. Turn the upper set screw counter-clockwise two revolutions.

B. Close the door.

C. While continuously checking "play" in the pressure pad arm turn the upper set screw clockwise until the "play" is gone.

CAUTION

Do not over tighten the presure pad arm as damage to diskettes may occur.

D. On the pressure pad arm, turn the adjustment screw until the head of the screw is just touching the head load solenoid arm.

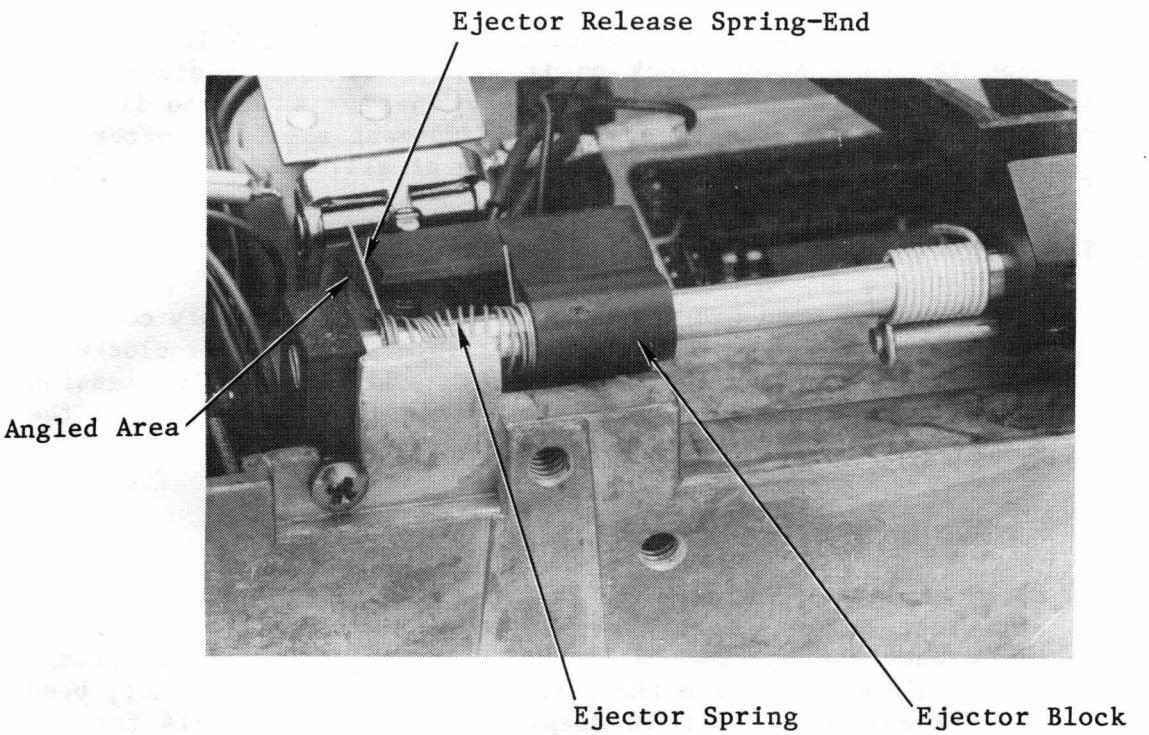


Figure 4-14: Ejector Spring

4.7 MEASUREMENT PROCEDURES

The following list of measurement procedures should be made periodically to ensure data quality or if malfunctions are suspected:

A. Compliance Measurement

B. Erase Measurement

C. High Frequency Playback Measurement

4.7.1 Compliance Measurement

To measure compliance perform the following steps in the order listed:

A. Apply power to the disk drive and select drive.

B. Step head(s) to track 76.

C. Write a 1F (hex) pattern (250 KHz) on the entire track.

D. Connect oscilloscope probes to TP4 and TP5 as in the radial-track alignment procedure (paragraph 4.6.1).

E. Apply a 15 gram load to the upper arm directly above the load pad (or upper head). If the amplitude observed on the oscilloscope increases by more than 10% the drive has poor compliance. Turn the set screw clockwise to increase the pressure.

CAUTION

Too much pressure will cause damage to the read/write head(s) and diskette.

4.7.2 Erase Measurement

To measure the effectiveness of the erase, perform the following steps in the order listed.

A. Apply power to the disk drive and select drive.

B. Step the head(s) to track 72.

C. Write a 1F (hex) pattern (250 KHz) on the entire track.

D. Connect oscilloscope to TP4 and TP5 as described in the radial-track alignment procedure (refer to paragraph 4.6.1).

E. Connect a jumper from ground to gate U24 pin 6.

F. Step back and forth across track 72 for about 15 seconds.

G. At the end of the 15-second period, remove jumper installed in Step E above and return head(s) to track 72. The amplitude displayed on the oscilloscope should be reduced by at least 85% in some parts of the trace.

H. If the amplitude decrease is less than 85%, refer to the troubleshooting information in section 5.

4.7.3 High Frequency Playback Measurement

To measure the amount of high frequency playback, perform the following steps in the order listed.

A. Apply power to the disk drive and select drive.

B. Step the head(s) to track 76.

C. Write a 2F (hex) pattern (500 KHz) on the entire track.

D. Connect oscilloscope to TP4 and TP5 as described in radial-track alignment procedure (refer to paragraph 4.6.1).

E. The peak-to-peak amplitude displayed on the oscilloscope should be a minimum of 230 mv p-p. If the amplitude is less, refer to the troubleshooting information in section 5.

SECTION 5

TROUBLESHOOTING

5.1 INTRODUCTION

This section contains general troubleshooting information. It is assumed that the user has read and understands the material in section 3, Theory Of Operation.

The first step in troubleshooting should be to verify that the controlling device and interface to the disk drive are functioning properly. Next, isolate the trouble to the electronic, the electro-mechanical, or the mechanical components of the drive. Table 5-1 is a list of some trouble symptoms referenced to paragraphs which include possible causes, and suggested fixes.

Table 5-1: Trouble Symptoms

Topic	Paragraph
Preliminary Troubleshooting Steps	5.2
Drive Won't Step or Steps Erratically	5.3
Head/Carriage Oscillates at Track 00 (Restore Error)	5.4
Drive Motor Won't Rotate	5.5
Head Will Not Load	5.6
Bad Index Output	5.7
Bad Write Protect Output	5.8
Activity Indicator Does Not Light	5.9
Read Errors--All Tracks	5.10
Read Errors--Random Tracks	5.11
Read Errors--Inside Tracks	5.12
Cannot Read Prewritten Data: Can Read Self-Written Data	5.13
Cannot Write Data	5.14
Erase Bad	5.15
Drive Speed Unstable	5.16

5.2 PRELIMINARY TROUBLESHOOTING STEPS

The following preliminary steps should be performed first when a suspected malfunction occurs:

A. Check for proper operation of controlling device and interface to disk drive.

B. Check for proper supply voltages to the printed circuit board assembly (refer to figure 3-2).

C. Check for proper insertion of terminator.

D. Check for proper programming of drive select and configuration jumpers (refer to section 6).

5.3 DRIVE WON'T STEP OR STEPS ERRATICALLY

A. Verify that head cable(s) do not interfere with carriage movement.

B. With DIRECTION input low, apply stepping pulses and monitor stepper motor control logic for proper signals as shown by timing diagram, Figure 3-7.

C. In order to step, gate U15 pin 6 must be a logic low.

D. If signals measured are as shown by Figure 3-7, replace the stepper motor (refer to paragraph 4.5.8).

5.4 HEAD/CARRIAGE OSCILLATES AT TRACK 00 (RESTORE ERROR)

A. Position the head/carriage to extreme rear of drive.

B. Check J5-12 for a high level. If it is not high, replace the track 00 sensor.

C. If J5-12 is high, check track 00 logic for correct signals.

5.5 DRIVE MOTOR WON'T ROTATE

A. Verify proper connection of P1 and P2 on the Spindle Speed Control PCBA.

B. Verify jumper connection B2 - C2 on control electronics PCBA is made. Check for a logic low at U28-9 and U20-2.

C. The MOTOR ON signal to the Spindle Speed Control PCBA must be a low level for the drive motor to rotate. Verify a logic low at J1-4 of the Spindle Speed Control PCBA.

D. Verify +24v on J1-1.

E. Check J2-11 of the Spindle Speed Control PCBA for approximately +24v. If present replace the drive motor (refer to paragraph 4.5.7). If not present replace the Spindle Speed control PCBA (refer to paragraph 4.5.1).

5.6 HEAD WILL NOT LOAD

A. Check J5-2 for a low level. If output is low, replace the head load solenoid (refer to paragraph 4.5.5).

B. Double-check the drive configuration for proper programming (refer to section 6).

5.7 BAD INDEX OUTPUT

A. Block both index sensors' LED light path. If J7-8 or 10 are at a low level, replace the index sensor assembly (refer to paragraph 4.5.15).

B. Remove diskette and close door. Check J7-8 and 10 for a low level; if low check for correct signal levels throughout the index logic. If either signal is high, replace the index sensor assembly (refer to paragraph 4.5.15).

5.8 BAD WRITE PROTECT OUTPUT

A. Block both write protect sensors' LED light path. J6-9 and J5-8 should both be a logic high. If J6-9 is a low level, replace the write protect sensor on the right as viewed from the front of the drive (refer to figure 4-1). If J5-8 is a low level, replace the write protect sensor on the left.

B. Unblock both write protect sensors' LED light path. J6-9 and J5-8 should both be a logic low. If J6-9 is a high level, replace the write protect sensor on the right as viewed from the front of the drive (refer to figure 4-1). If J5-8 is a high level, replace the write protect sensor on the left.

C. Check for correct signal levels throughout the write protect logic.

5.9 ACTIVITY INDICATOR DOES NOT LIGHT

A. Activate the activity indicator and look for a logic low signal on J7-2.

B. If J7-2 is high, check activity indicator logic for correct signal levels.

C. If J7-2 is low, look for a broken wire then replace the activity indicator.

5.10 READ ERRORS—ALL TRACKS

A. Verify that head is loaded by visually checking that head load pad (or upper head on Model 42) contacts diskette. If head is not loaded refer to paragraph 5.6.

B. Check compliance (refer to paragraph 4.7.1). If compliance is bad, clean head and/or replace load pad assembly ((refer to paragraph 4.5.18).

C. Check read logic for proper signals as compared with timing diagram, Figure 3-6.

D. Check for a poor connection or a broken wire on the head cable(s).

E. Replace the Control Electronics PCBA. If there still is no read signals from the drive, replace the head/carriage assembly (refer to paragraph 4.5.10).

5.11 READ ERRORS—RANDOM TRACKS

A. Check for an intermittent connection of the read/write head connector.

B. Replace the Control Electronics PCBA (refer to paragraph 4.5.1).

C. Replace the Spindle Speed Control PCBA (refer to paragraph 4.5.1).

D. Replace the spindle drive motor (refer to paragraph 4.5.7).

5.12 READ ERRORS—INSIDE TRACKS

A. Check compliance (refer to paragraph 4.7.1). If compliance is bad, replace load pad assembly (refer to paragraph 4.5.12), and/or clean head.

B. Check erase capability (refer to paragraph 4.7.2). If erase is bad, see paragraph 5.15.

C. Check high frequency output (refer to paragraph 4.7.3). If output is bad, replace the head/carriage assembly (refer to paragraph 4.5.10).

5.13 CANNOT READ PREWRITTEN DATA: CAN READ SELF-WRITTEN DATA

A. Check radial-track alignment (refer to paragraph 4.6.1).

B. Check index-to-data alignment (refer to paragraph 4.6.2).

5.14 CANNOT WRITE DATA

A. Check the WRITE PROTECT output signal (refer to paragraph 5.8).

B. Check the Control Electronics PCBA write circuits for correct signals per timing diagram, Figure 3-8.

5.15 ERASE BAD

A. If no decrease in amplitude is observed after the 15 second period outlined in paragraph 4.7.2 (Erase Measurement), first try replacing the Control Electronics PCBA (refer to paragraph 4.5.1). If that doesn't rectify the problem then replace the head/carriage assembly (refer to paragraph 4.5.10).

B. If the amplitude decrease is less than 85%, try cleaning the head(s); then replace the load pad assembly (refer to paragraph 4.5.12).

5.16 DRIVE SPEED UNSTABLE

A. Check for bad spindle bearings by removing drive belt and slowly rotating spindle pulley manually. If spindle pulley rotates erratically, replace spindle bearings (refer to paragraph 4.5.13).

B. If spindle speed drifts slowly, replace the Spindle Speed Control PCBA (refer to paragraph 4.5.1).

SECTION 6

OPTIONAL CONFIGURATION

6.1 INTRODUCTION

The Model 40 Series can be modified by the user to function differently than the standard configuration. These modifications can be implemented by adding and/or deleting jumpers and/or using unused I/O pins. Figure 6-1 shows the location of the jumper connections on the PCB. Table 6-1 lists the standard jumper configuration of the Model 40 Series PCB as shipped. Figure 6-2 illustrates those jumpers installed on the standard Model 42 drive as shipped. This section will describe all of the options which are available to the user and will explain how to implement them. Table 6-2 lists these options and their location within this section.

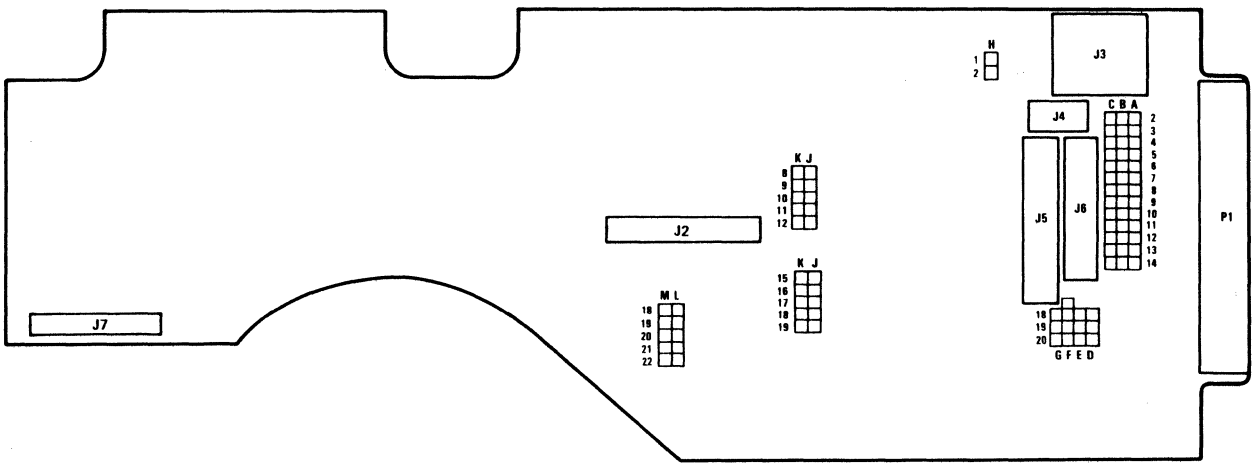


Figure 6-1: Control Electronics PCBA Jumper Locations

Table 6-1: Standard Jumper Configuration

A4 - A5 *	J8 - J9
A6 - A7	J17 - J18 *
B2 - C2	J18 - J19 **
B8 - C8	K9 - K10
B9 - B10	K11 - K12
B11 - C11	K18 - K19
C6 - C7	L18 - M18
D18 - E18	L19 - L20
F17 - F18	L21 - L22
H1 - H2	M19 - M20

* Installed only on Model 42 drives.
** Installed only on Model 41 drives.

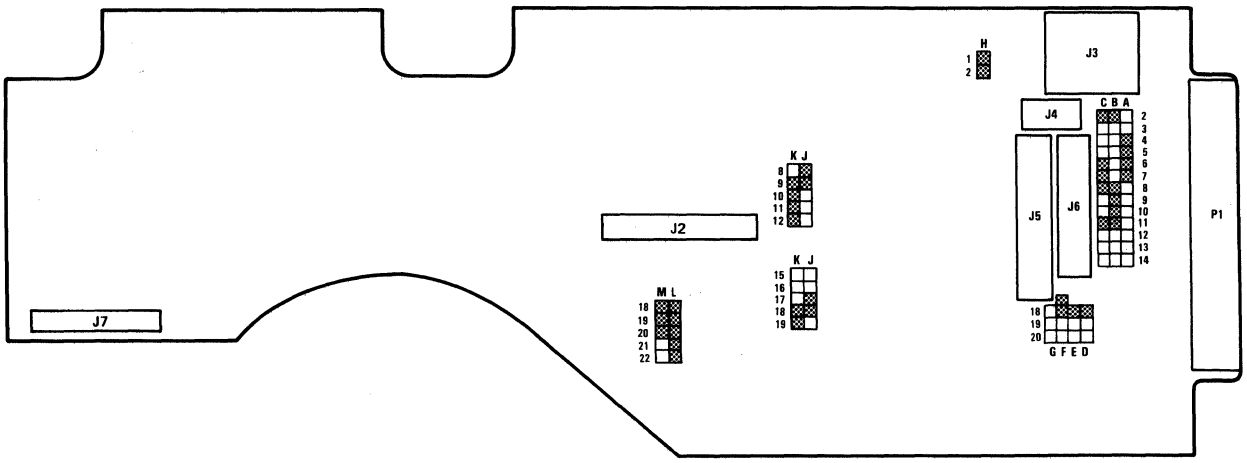


Figure 6-2: Standard Model 42 Jumper Configuration

Table 6-2: Optional Configuration

MODIFIED OPERATION	PARAGRAPH
Drive Select Reconfiguration	6.2
Select Drive without Loading Heads or Enabling Stepper Motor.	6.3
Select Drive and Enable Stepper Motor without Loading Heads .	6.4
Hard Sectored Diskette with 32/16/8 Sectors	6.5
FM Separated Data and Clock	6.6
External Motor On	6.7
Write Current Switch.	6.8

6.2 DRIVE SELECT RECONFIGURATION

In the standard configuration, the activation of DRIVE SELECT 1 will load the read/write heads, enable the stepper motor, enable the output lines, lock the door, and light the activity LED. Four separate DRIVE SELECT lines are provided so that up to four drives may be connected to a single controller. Jumpers B11 - C11, B12 - C12, B13 - C13, and B14 - C14 correspond to DRIVE SELECT 1, 2, 3, and 4, respectively. By placing only one of these jumpers in each drive, only one drive will be selected when activating any one of the DRIVE SELECT lines. Figure 6-3 illustrates this option.

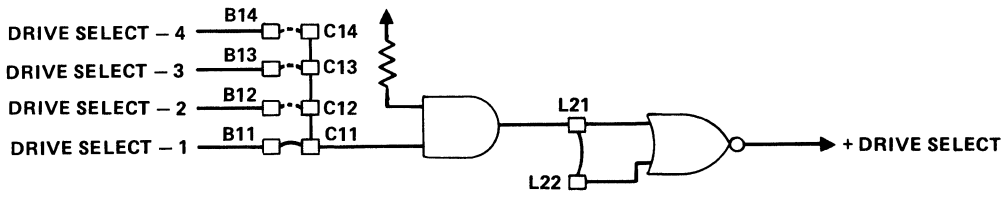


Figure 6-3:

6.3 SELECT DRIVE WITHOUT LOADING HEADS OR ENABLING STEPPER

In the standard configuration, the heads are loaded and the stepper motor is energized when DRIVE SELECT is enabled. With this option the user may keep the drive selected all the time so that the output status can be monitored while the heads are unloaded, which will extend head and media life. Heads can be loaded when required by activating the HEAD LOAD interface line (pin 18) which also will enable the stepper motor. After the HEAD LOAD line is activated, a 35 ms delay is required before WRITE GATE and WRITE DATA are applied to the drive or before READ DATA is valid. This delay is the head load time.

If more that one drive is assigned to the controller, separate I/O pins should be used as HEAD LOAD lines for each drive. These unused I/O pins need to be connected to jumper-pin C3. This can be accomplished by soldering a wire between the unused pin and C3.

Pin 2, pin 6, and pin 8 can be used to implement this option, however certain restrictions will apply. Pins 6 and 8 are spares, but pin 2 can also be used as an external write current switch. When used as a head load line its alternate function can not be implemented (refer to paragraph 3.5.3).

To install this option on a standard drive, the following jumpers must be added and deleted. Figure 6-4 illustrates this option.

A. Remove jumper L18 - M18

B. Install jumper C3 - C4

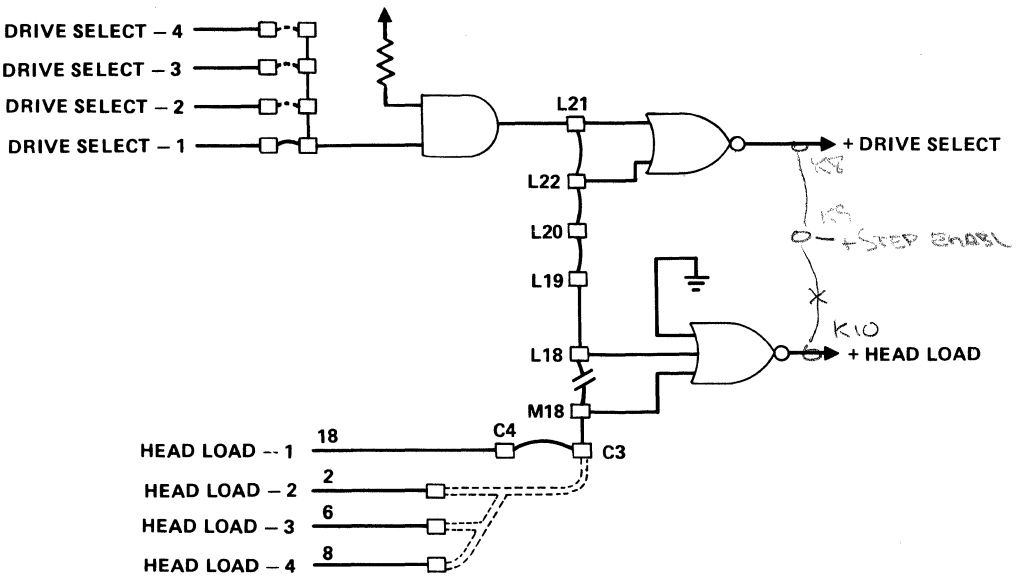


Figure 6-4:

6.4 SELECT DRIVE AND ENABLE STEPPER MOTOR WITHOUT LOADING

This option allows a seek operation without loading the heads when the drive is selected. Using this option, the track position can be initialized with a not ready condition in the drive. For read or write operations the head must be loaded using the HEAD LOAD interface line (pin 18). If more than one drive is assigned to the controller, separate I/O pins should be used as HEAD LOAD lines for each drive.

These unused I/O pins need to be connected to jumper-pin C3. This can be accomplished by soldering a wire between the unused pin and C3. Pin 2, pin 6, and pin 8 can be used to implement this option, however certain restrictions will apply. Pin 8 is a spare, but pin 2 and pin 6 can also be used as an external write current switch and external motor on respectively. When used as a head load line its alternate function can not be implemented (refer to paragraph 3.5.3).

To install this option on a standard drive, the following jumpers must be added and deleted. Figure 6-5 illustrates this option.

A. Remove jumper L19 - L20

B. Remove jumper K9 - K10

C. Install jumper K8 - K9

D. Install jumper C3 - C4 (On additional drives, remove jumper C3 - C4 and solder a wire from the unused I/O pin to C3)

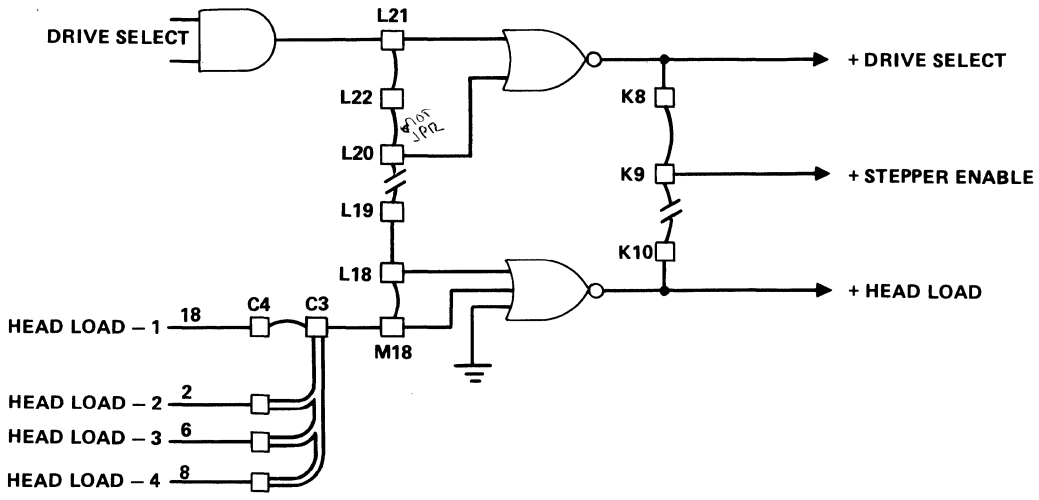


Figure 6-5:

6.5 HARD SECTORED DISKETTE WITH 32/16/8 SECTORS

In hard sectored diskettes, the index hole is placed halfway between sector holes 31 and 0. Therefore additional circuitry is required to demultiplex the INDEX pulse from the SECTOR pulses. Typically, hard sectored diskettes have 32 sectors. The MPI Model 40 Series can also provide either 16 or 8 hard sectors from a 32 sector diskette. To install this option add and delete the following jumpers. Figure 6-6 illustrates this option.

A. Remove jumper K18 - K19

B. Install jumper B6 - B7

C. Install jumper K17 - K18

D. Install jumper (G19 - G20 for 32 Sectors)

(F19 - G19 for 16 Sectors)

(G18 - G19 for 8 Sectors)

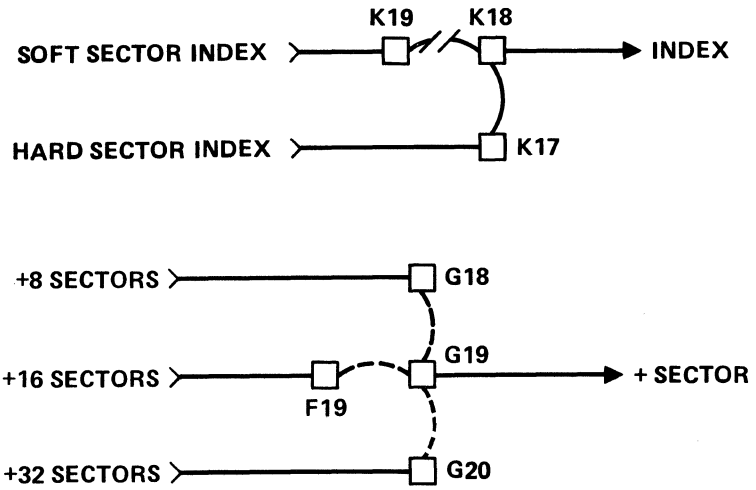


Figure 6-6:

6.6 FM SEPARATED DATA AND CLOCK

This optional output line provides separated data and clock bits from raw read data for soft sectored standard IBM format or standard format for FM encoding only. To install this option add the following jumpers. Figure 6-7 illustrates this option.

A. Install jumper D19 - D20

B. Install jumper E19 - E20

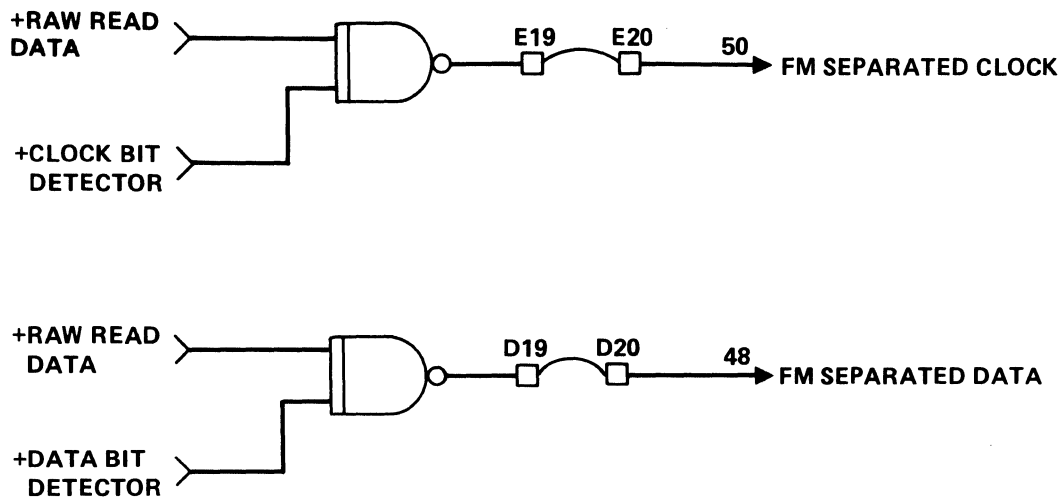


Figure 6-7:

6.7 EXTERNAL MOTOR ON

In the standard drive the spindle motor is enabled and will rotate at 360 RPM when power is applied. This optional configuration enables the controller to turn on/off the spindle motor. To install this option add and delete the following jumpers. Figure 6-8 illustrates this option.

A. Remove jumper C2 - B2

B. Install jumper A2 - B2

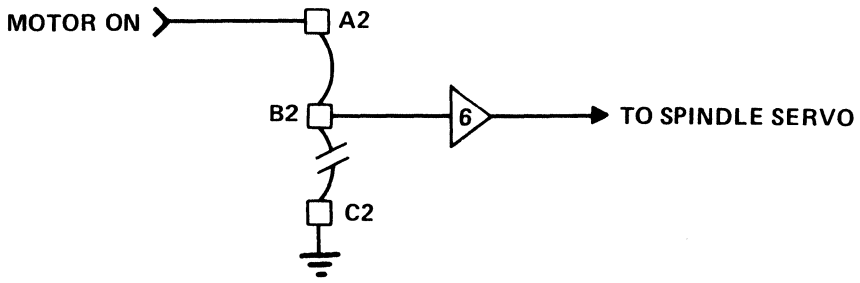


Figure 6-8:

6.8 WRITE CURRENT SWITCH

This optional input is an alternate function to the TRACK 43 internal sensor signal in the drive. When installed and active, this input line will switch write current to a lower level for inner tracks 43 thru 77. To install this option add and delete the following jumpers. Figure 6-9 illustrates this option.

A. Remove jumper K11 - K12

B. Install jumper J12 - K12

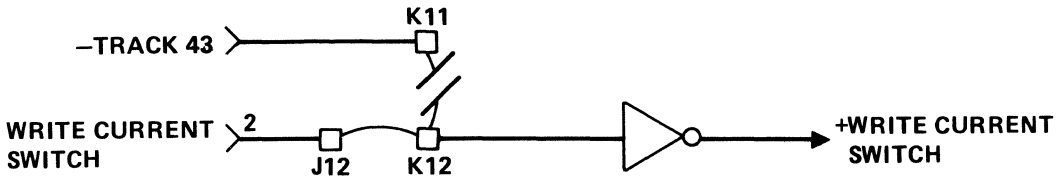


Figure 6-9:

APPENDIX A

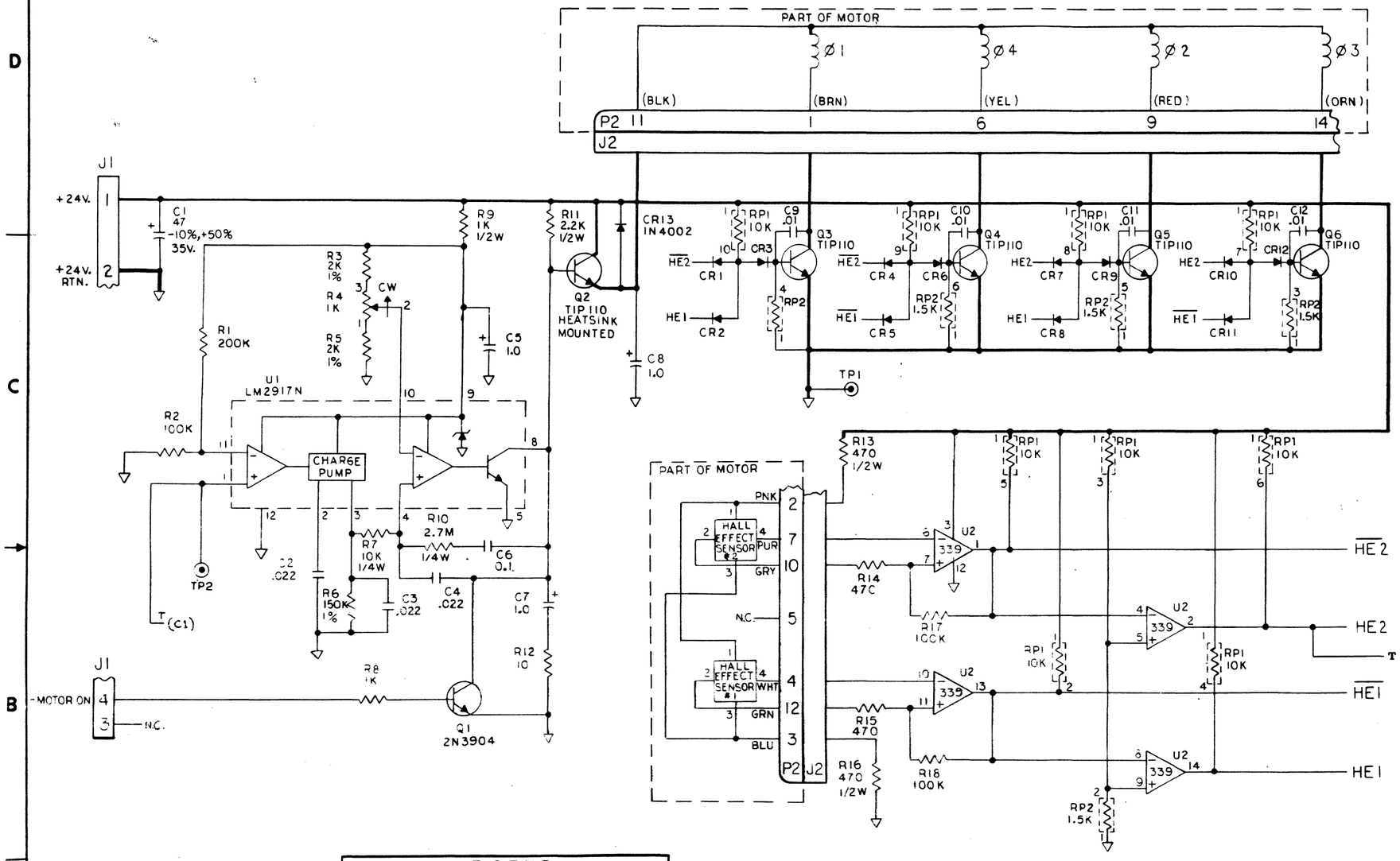
RECOMMENDED SPARE PARTS LIST

PART NUMBER	DESCRIPTION	MODEL	UNIT QUANTITY				
		40 Series	1	2-99	100-499	500-999	1000 +
35023-001	Load Pad Assy	41	1	2	4	6	8
64006-001	Solenoid - Head Lift	ALL				1	1
21-AAAAAA	Logic PCB Assembly	ALL			1	2	2
29022-001	Motor Control PCB, Brushless	ALL				1	2
70008-001	Ejector Spring	ALL		1	1	2	3
70005 001	Latch Spring	ALL					1
35063-001	Index Sensor Assembly	ALL			1	1	2
35058-001	Dual Head Carriage Assembly	42					1
35062-001	Sensor Mount Assembly	ALL		1	1	2	4
35061-001	Drive Motor Assy, Brushless	ALL			1	1	2
35026-001	Activity Indicator Assy	ALL			1	1	2
50501-001	Drive Belt	ALL		1	1	2	2
35060-001	Stepper Motor Assembly	ALL			1	1	1
27065-001	Band, Carriage Drive	ALL			1	1	2
27083-001	Band Tensioning Spring	ALL			1	1	2
35057-001	Single Head Carriage Assy	41					1
35069-001	Pawl Shaft Assembly	ALL					1
27072-001	Pressure Pad	ALL					1
22068-001	Block, Arm Adjust	ALL					1
21053-001	Latch Button	ALL				1	1
27073-001	Adjustment Plate	ALL				1	1
35067-001	Cone Assembly	ALL				1	2
29022-002	Motor Control PCB, Brush-type	ALL				1	2
35074-001	Drive Motor Assy., Brush-type	ALL		1	1	2	3
03028-001	Product Manual	ALL	1	1	1	1	1
79801-428	Alignment Diskette	ALL	1	1	1	1	1

APPENDIX B

DRAWINGS AND SCHEMATICS

REVISIONS					
ZONE	LTR	DESCRIPTION	BY	DATE	APPROVED
—	NEW	REL. TO PROD.			
—	A	ADDED: TP1 & 2, J14	R.J.	10-2-81	
—	B	UPDATED	R.J.	10-16-81	
—	C	REVERSED PINS 1 & 2 OF J1 (ZONE C, D-8) ADDED PIN 1 TO U2, RP1 & 2 (ZONE B-4)	D.F.	12-7-81	
—	D	REVISED PER CRO # 661	D.F.	7-1-82	
—	E	REVISED PER CRO # 712	BRR	5-24-82	



LEGEND

REF DESIG	LAST USED	OUT OF SEQUENCE	DELETED	REMARKS
R	R21			
C	C12			
CR	CR13	CR13		
Q	Q6			
AR				
L				
J	J2			
U	U2			
RP	RP2			
TP	TP2			

5. ALL DIODES ARE IN4446.
4. INTERPRET DRAWING PER Y32.2
3. CAPACITORS ARE IN UF, ±10%, 35V OR GREATER.
2. 1% RESISTORS ARE 1/8W.
1. RESISTORS ARE IN OHMS, ±5%, 1/4W.

NOTES: UNLESS OTHERWISE SPECIFIED.

NEXT ASSY	USED ON
APPLICATION	41/42

DO NOT SCALE DRAWING

QTY REQD	CODE IDENT	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION
			PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS XX ± XXX ± ANGLES ±

MATERIAL

FINISH

CONTRACT NO.

APPROVALS	DATE
DRAWN W. RAY JOHNSON	8-10-81
CHECKED	

MPI MICRO PERIPHERALS INC.

SCHEMATIC DIAGRAM — BRUSHLESS DC SPINDLE MOTOR CONTROL SYSTEM, 8 IN. FLOPPY

SIZE	CODE IDENT NO.	DRAWING NO.	REV.
D		4-04014-001	E

SCALE — SHEET 1 OF 2

DWG. NO. 4-04014-001 PART REV.

BISHOP GRAPHICS/ACCUPRESS RECORDER NO. A-0862

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		SEE SHEET 1		

HEAD Ø
HEAD 1
+SIDE SELECT
+ERASE
+WRT CURR SW (K12)
+WRITE DATA
+WRITE ENAB
-ERASE
24-1 +ERASE
-STEP INHIB
30-4,5
35-12
35-11
TP1 TP2 TP3 TP4 TP5 TP6 TP10
H1 H2

75477	U24		
75477	U24		
7407	U1		
LS04	U20		
LS74	U12		
7407	U1		
7407	U1		
7407	U1		
7407	U1		
75476	U13		
555	U14		
LS04	U20		
9602	U11		
9602	U11		
LS123	U17		
LS02	U18		
LS113	U19		
LS86	U10		
LS86	U10		
LS123	U17		
LS74	U12		
NE592	U6		
NE592	U5		
LM360	U4		
LM340	VR1		

Q1	2N3906		
Q2	2N5772		
Q3	2N3906		
CR1	IN5232B		
CR2	IN5232B		
CR3	IN52268		
CR4	IN52268		
CR5	IN52268		
CR6	IN52268		
CR7	IN52268		
CR8	IN52268		
CR9	IN52268		
CR10	IN52268		
CR11	IN52268		
CR12	IN52268		
CR13	IN52268		
CR14	IN52268		
CR15	IN52268		
CR16	IN52268		

R1	3.3K		
R2	1K		
R3	680		
R5	10K		
R6	4.7K		
R7	10K		
R10	1K		
R11	4.7K		
R12	4.7K		
R13	1K		
R14	1K		
R15	1K		
R16	1K		
R17	1K		
R18	75		
R19	4.7K		
R20	27K		
R21	27K		
R22	4.7K		
R23	2K 1%, 1/8W		
R24	383 1% 1/8W		
R25	5.9K 1% 1/8W		
R26	7.5K 1% 2W		
R27	383 1% 1/8W		
R28	10K		
R29	10K		
R30	22K		
R31	22K		
R36	7.5K		
R37	5.6K		
R38	1.4K, 1/8W 1%		
R39	3.3K		
R41	4.7K		
R42	4.7K		
R43	33K		
R47	15K		
R48	220		
R49	47K		
R50	1K		
R51	100		
R52	150		
R56	5K		
R57	1K		
R58	1K		
R5	10K		

C1, C21-C24, C26, C32, C33	.01μF, 20%		
C2	330pf 5%		
C3	.1μF		
C4	4.7 35V		
C5	4.7 15V		
C6	1000 pf		
C7	.022μF		
C8	.022μF		
C9	.1μF 20%		
C10	390pf 5%		
C11	270pf 5%		
C12	68pF 5%		
C13	.1μF		
C14	.1μF		
C15	.2		
C16	.1		
C17	4.7μF/15VDC		
C18	330 pf 5%		
C19	330 pf, 5%		
C20	68 pf, 5%		
C27	330 pf, 5%		
C28	330pf 5%		
C29	1000 pf, 5%		
C30	0.1μF		
C31	.01μF 20%		
C39	.1μF 20%		
C40	.1μF 20%		

L1			
L2	220μH		
L3	1000μH		
L4	1000μH		
L5	330μH		
L6	330μH		

J2			
J3			

+ 24 VDC	J3-1		
+ 24 VDC RTN	J3-2		
+ 5 VDC	J3-5		
+ 5 VDC RTN	J3-3,6		
+24V			
+24VF			
+12V			
+6VA			
+5V			
+5VD			
ANALOG SIGNAL GROUND			
DIGITAL SIGNAL GROUND			
FRAME GROUND			

3. ALL INDUCTORS ARE 10%.
2. ALL CAPACITORS ARE 50 WVDC, 10%.
1. ALL RESISTORS ARE 1/4 W, 5%.
NOTES: UNLESS OTHERWISE SPECIFIED.

QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
			PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO

APPROVALS	DATE
DRAWN GROUP J INC.	OCT-20-80
CHECKED	

SCHEMATIC — LOGIC BOARD 8 INCH FLOPPY

SIZE	CODE IDENT NO	DRAWING NO	
D		4-04016-001	01

SCALE — SHEET 2 OF 3

NEXT ASSY	USED ON
	41/42

APPLICATION

MPI

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		SEE SHEET 1		

INDEX/SEL 1 PT
INDEX/SEL Ø PT
TRACK 43
WRT PROTECT 1
WRT PROTECT Ø
TRACK 00
SIDE SELECT
DIRECTION
STEP
WRITE GATE
HEAD LOAD
IN USE
DRIVE SELECT 1
DRIVE SELECT 2
DRIVE SELECT 3
DRIVE SELECT 4
MOTOR ON
WRITE DATA

+SIDE SELECT
-WRITE GATE
-ERASE
-STEP INHIB
+WRT ENB
+TRACK 43
+WRITE DATA
U1-3

P1
22 READY
20 INDEX
24 SECTOR
10 TWO SIDED
12 DISK CHANGE
44 WRT PROTECT
42 TRACK 00
46 READ DATA
48 SEP DATA
50 SEP CLOCK
8 SPARE
6 SPARE

J4
PHASE 4 (BLU)
COMMON (BLK)
PHASE 3 (GRN)
PHASE 2 (RED)
PHASE 1 (WHT)

J5 HEAD LOAD
J6 MOTOR ON
J7 DOOR LATCH
ACTVT LED

QTY REQD	CODE IDENT	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION
			PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL
FINISH
DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN GROUP J INC.	OCT-20-84
CHECKED	

41/42
NEXT ASSY / USED ON
APPLICATION

MPI

SCHEMATIC — LOGIC BOARD 8 INCH FLOPPY

SIZE D | CODE IDENT NO | DRAWING NO 4-04016-001 | D1
SCALE — | SHEET 3 OF 3